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Balancing Armatures and Other Rotating Parts of Machinery.

BY WM. BAXTER, JR.

Balancing rotating parts of machinery by the use of parallel horizontal bars is a very tedious process, and, except in a few cases, is not accurate. If it is desired to balance a pulley, it can be done by this method with all the accuracy necessary in practice, providing the face is not too wide and the shaft upon which the pulley is mounted, as well as the bars, are hardened and ground true. If the face is unusually wide, good results cannot be obtained, unless the workman is sufficiently skilled to be able to judge as to the probable location of the heavy spot. If, instead of a pulley, we undertake to balance a shaft upon which are mounted a number of parts, as, for example, an electric motor or generator armature shaft, a perfect balance can only be obtained by chance. This is due to the self-evident fact that a static balance is not necessarily a running balance. As an illustration, take the armature shaft shown in Fig. 1; if it is out of balance by reason of an irregularity in the shape of the wire over the end, as shown by the dotted line at *B*, it can be balanced statically by placing a sufficient amount of weight at any point on the opposite side of the diameter; but, to obtain a running balance, it is necessary that the weight be placed as nearly opposite to the point *B* as possible.

If the outward appearance always indicated the point where the unbalanced weight is located, an experienced workman could obtain results good enough for all practical purposes, by the use of the ordinary parallel bars; but, as a rule, there is nothing to assist one in determining where to place the counterbalancing weight; hence, accuracy is more the result of chance than judgment.

The lack of a perfect running balance is not always noticed, because, if the static balance is good, the unbalanced running condition only tends to wabble the machine around a point near its center of gravity, and not to move it bodily; therefore, if it is well secured to a solid foundation, little or no external jar may be perceptible, but the strain upon the rotating parts and the bearings will be just as great as if the machine shook.

To obtain greater accuracy in the balancing of armatures, and also to reduce the cost of the operation, the writer devised the apparatus shown in Figs. 2 and 3, the former being a side view and the latter an end view showing a section through the frame *F* on the line *S*—*S*. The construction shown in the figures is such as to afford considerable adjustment. Fig. 2 shows the position of the various parts when set for the greatest length of shaft, and Fig. 3 the position for the smallest diameter of armature. The shaft supports *G* can be moved closer together, for shorter shafts, and the magnets *M* can be spread so as to take in a larger diameter of armature than shown in Fig. 3. This apparatus, by a slight modification which will suggest itself to anyone, can be adapted to the balancing of any kind of rotating mechanism; this fact will be better understood when its operation is explained. The armature *A* is mounted in the bearings *J*, which are held by the supports *G*. The brushes *F* and the pole pieces *P* are properly adjusted, and then an electric current is passed through the magnets *M* and the armature, so as to set the latter in motion. The whole apparatus is hung from the ceiling, or any other suitable support, by means of the rods *H*, and is therefore perfectly free to swing in any direction.

As soon as the armature begins to revolve, the apparatus will vibrate sideways if the armature is out of balance, and it will necessarily follow the motion of the heavy part of the armature. If there is a heavy point, as at *B* in Fig. 1, that end will swing the most; and if there are two heavy points and they are on opposite sides, as shown by *B* and *B'*, one end will go to one side, while the other will go to the other side. By placing upon the floor, at convenient points, stands that are perfectly rigid, the shaft can be chalked at the points *C* and *D*, and then the location of the heavy spots can be determined from the chalk-marks, and the counterbalance be put in place. The armature is then set in motion again and the shaft chalked a second time. Such changes are

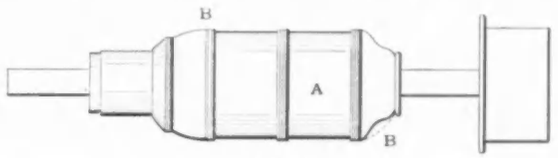

Fig. 1

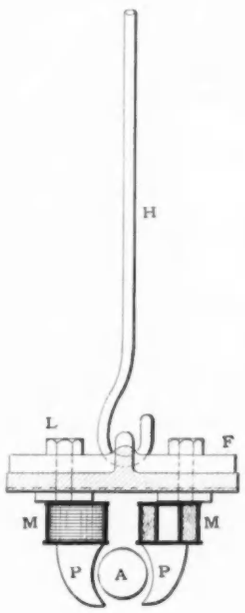

Fig. 3

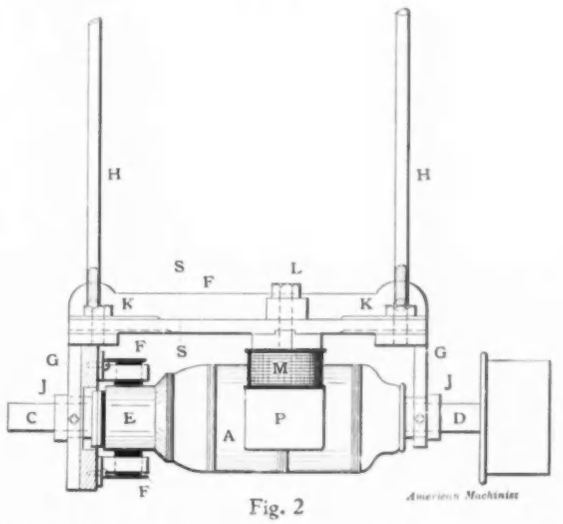

Fig. 2

BALANCING ARMATURES.

then made in the counterbalancing as may be thought necessary, and the process kept up until a perfect balance is obtained.

The advantages of this method are that a perfect running balance is obtained, and that the time required to do it is very much less than by the use of bars. As everyone knows, when an object that is being balanced by the latter method is very much out, it will soon come to a standstill when set rolling; but as the work progresses, the time required for the shaft to come to rest is increased; and when the balance is nearly perfect, it not only takes a greater length of time for the shaft to come to rest, but it will not stop at the same point every time, and, consequently, several trials must be made before the exact position of the heavy side is ascertained. With the apparatus here shown, the action is very different. When the armature is first rotated, the velocity is made slow, as, on account of being considerably out of balance, a low speed will cause all the side motion necessary to indicate the position of the heavy spots. As the point of perfect balance is approached, the velocity is increased; therefore the chalking can be done as quickly toward the end of the operation as at the start. The time required to determine on what side the heavy part is located is as much as is necessary for a man to chalk the two ends of the shaft, which, it will be admitted, is but a small fraction of the time consumed in determining the point by the process of rolling on parallel bars.

As the power required to rotate the armature is small, only enough to overcome the friction, it is not necessary to have a large field magnet, and it matters little whether the various parts are in proper electric proportion or not; on this account it is possible to use one apparatus for several sizes of armatures. In the machine shown, the poles are bored out large enough to take in the armature shown in Fig. 2, and, as a consequence, will not fit very well around the smaller size shown in *F*, Fig. 3, but they will fit well enough to set the armature in motion, and that is all that is required. By making the bushings *J* narrow, a space is left on the shaft for chalking.

The brush-holders are held upon a wooden ring that is secured to the support *G*, and is arranged so that it may be shifted around the circle to admit of adjusting the brushes to a point where they will not spark so much as to injure the commutator while the balancing is being done. To use this apparatus for balancing rotating parts generally, it would be necessary to make the armature a fixture; and to extend the frame *F* sufficiently to afford suitable bearings, the whole apparatus would have to be balanced by itself, so that, when running alone, it would not shake; then, when the part to be balanced was put in place, weight would be added or taken off one side until all vibration was arrested. In such an arrangement it would be advisable to design the armature and field so as to be in proper proportion, electrically as well as mechanically. Motion could be imparted to the shaft without resorting to electricity, but it would be difficult to devise any mechanical means that would be as free from outside causes that would interfere with the free swinging of the apparatus, and this is the essential feature. If the motion is retarded by external resistance, it will cause the extremely light oscillations produced, when the balance is nearly perfect, to be interfered with; therefore, the freer the swing of the apparatus, from all external interference, the greater the accuracy of the results.

The apparatus, as shown, could be used for balancing pulleys, as they could be placed upon the end of the shaft, by using bushings of a suitable size.

It may hardly be necessary to add that the apparatus must be used in a location where the stands upon which the hand is rested in chalking the shaft, will be entirely free from vibration; under any other condition, the side running out could not be determined, when the apparatus is very nearly in balance, for then the shaft would run but slightly out of true, and, as every mechanic knows, the nearer true the shaft runs, the more difficult it is to chalk it, and this difficulty is increased if the support for the hand is not steady.

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The Cost of Labor in Japan.

The correspondent of the "Engineer," London, at Tokio contributes some information to that paper regarding wages and output in Japan, from which we extract the following:

"It is true that, in comparison with European standards, the wages paid in Japan are very low, but they are daily increasing, and by the time that Japan has come to the front as a modern industrial power, it is safe to predict that her wages will have reached a figure which will be the equivalent, or nearly so, of those paid in certain European countries. So far as I can gather, the wages of skilled men average about one-sixth of the wages paid for similar work in Great Britain. The capacity for work of a Japanese fitter and machine hand does not exceed half that of the European, while for smith's work three Japanese are required to do the work of one Englishman.

"Taking it generally for granted that the effective capacity of the Japanese skilled workman is half that of the Englishman, and that his wages are equal to one-sixth, it results that for a given amount of work turned out, the wages paid in Japan are one-third of those paid in England.

"A comparison on similar lines between the wages of Germany and Japan, would show that the latter country pays about two-thirds of the wages paid in the former for a given amount of work.

"It is natural that in a country where modern engineering dates only from a few years back, the effective capacity of the majority of the hands must be low. The rapid development of manufacturing engineering here has further increased this difficulty of want of efficiency of the skilled men, by causing the supply to be far below the demand.

"The natural consequence of all this is that when men are taken on they have to be practically taught their trade. English manufacturers who have had a strike, and have endeavored to carry on work temporarily with apprentices and new hands, even when these latter are skilled, will realize to some extent the disadvantages under which Japanese manufacturers are laboring while getting their men into shape, and at the same time carrying on their work.

"This want of efficiency in the Japanese mechanic, and which is habitually exaggerated, is lessening day by day. It only stands to reason that it is impossible to educate artisans of this class on any large scale at a few years' notice, as it requires a generation at least to develop trade of this sort. In ten years' time, when the thousands of boys who are now assiduously learning the trade have grown into men of some experience, things will be greatly changed, and in twenty or twenty-five years from now, one may safely predict that there will be no dearth of competent engineering hands in this country.

"By that time, too, the rate of wages will have advanced, possibly, to an equality with those of Europe, for the needs of the men will have increased in measure as the country is Europeanized. When this has been effected, there is every reason for supposing that Japan will have become an engineering center of great importance, and everything points to the Japanese workman being perfectly capable of turning out thoroughly good machinery.

"At present the cost of materials, which have largely to be imported, goes far to counterbalance the low scale of wages. But this difficulty will diminish with time, for most of the materials are here, and the Japanese are rapidly learning to work them.

"Harrowing pictures are sometimes drawn of the sufferings of a community where wages are so low, but I can only say of the countries that I have visited in Europe, Africa, North and South America and Australia, I have not found one where the poorest classes live so comfortably, and are so cleanly in their surroundings and apparently contented, as the Japanese.

"In conclusion, I would point out, that while in some ten or twenty years from now, Japan may become capable of supplying most of her own needs in the way of machinery and engineering products, European engineers have nothing to fear from her as a serious competitor in this way for many years to come, either as re-

gards the quantity or the quality of her manufactures. Japan has not yet got the plant necessary to turn out anything like the quality, nor has she the skilled men, nor the experience necessary to establish the quality of her products in the engineering trade. One thing, however, is certain, and that is, that she is leaving no stone unturned to arrive at surmounting these difficulties, and on broad lines, one may say she is going the right way to attain her object."

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A New Bevel Protractor.

The engravings presented herewith will serve to give an idea of the construction of a new bevel protractor possessing a number of novel and interesting features.

The tool consists of a semi-circle of sheet steel *a*, graduated and figured; a smaller semi-circular washer of about the same thickness and a straight blade *b* having one edge in line with straight sides of semi-circles, extending to the center and held in place by rivets. Upon and accurately fitted to the large semi-circle is a movable sector *c*, of about 90°, from one side of which extends a bush with large thumb nut *d* (Fig. 3) to clamp same in any position. On the opposite side is a radial straight edge or shoulder. Held against this shoulder by means of a bolt *e* (through bush) with a beveled head and smaller thumb nut, is a blade *f* having one end inclined at an angle of 45°. This blade can be clamped in three different positions (see Fig. 2). Position No. 1 gives angles from 0° to 90°; No. 2, 90° to 180°; No. 3, angles from 0° to 90°, with blade in a position to be used on a drafting board in connection with a T-square.

This protractor has both blades in the same plane; is flat on one side, so that both blades come in contact with work or drawing, avoiding the objectionable offset blades, as in the ordinary tool, while the straight edges of semi-circles furnish the offset blade if desired.

In positions 1 and 2 (Fig. 2), one edge of each blade is radial and extends entirely to the apex of the angle.

The sector can be moved to any position and clamped or unclamped without loosening the detachable blade.

The graduated arc is 4 inches in diameter, graduated to degrees and figured from 0° to 180°, double row; i. e., so that any angle from 0° to 180° is read directly. The zero line is in the same plane with the graduations, and the blades are about 7 inches long.

A variation of this tool is made especially for draftsmen. In this the blades are both fast, and their edges are so arranged as to be adapted to the use of ruling pens. It is graduated in degrees and has a vernier reading to 5 minutes of arc. In the tool made for draftsmen, the blades are somewhat closer together, and the tool is simply shifted from one position to the other, as seen in Fig. 4, laying off angles either side of the vertical, and it is thus never necessary to turn it over on the board; while the clamping nut serves as a convenient handle.

The tool is made by Coffin & Leighton, Syracuse, N. Y.

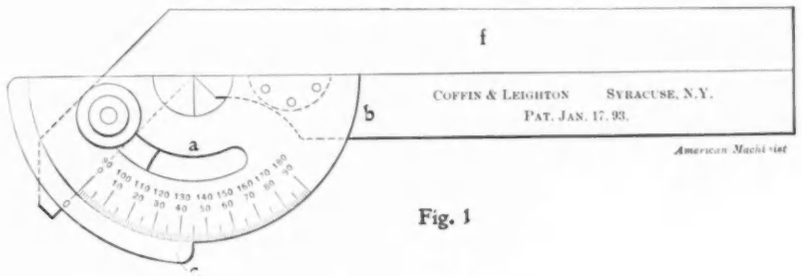

Fig. 1

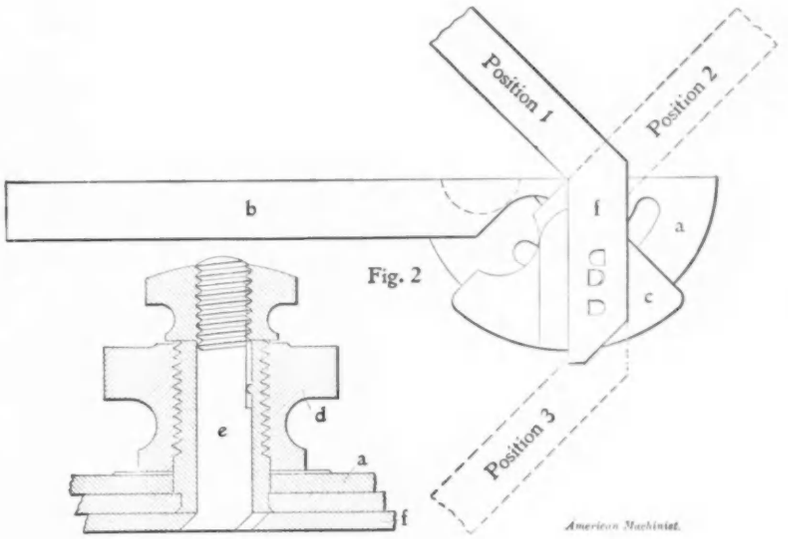

Fig. 2

Fig. 3

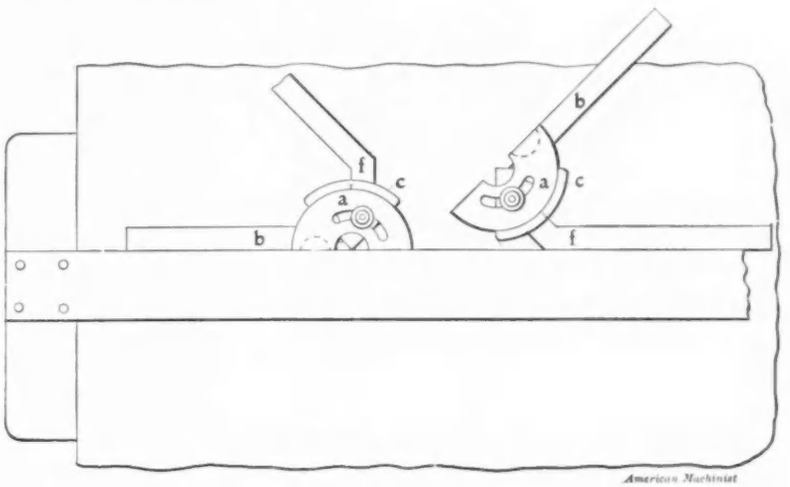

Fig. 4

A NEW BEVEL PROTRACTOR.

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One of the uses to which the current from the Folsom-Sacramento electric plant, recently described in these columns, is being put, is the driving of a sawmill. One 75, two 50 and three 30 horse-power General Electric induction motors are in use, the output of the mill being 50,000 feet of lumber per day. This is said to be the first electrically-driven sawmill.

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Fleet Engineer Burnap, of the United States steamer "Olympia," has broken down from overwork.

The Engineer in Naval Warfare.

[Conclusion.]

BY AN EX-NAVAL ENGINEER.

Continuing our review of the Line Symposium, Captain Mahan says: "And as it is on deck, so it is in the engine room. *The man in charge there* [italics mine], himself in his sphere, exercises a control as absolute as the captain and the officer of the watch—like them absolute, like them limited." Now, the only trouble with this statement is, that it is not and never has been true. If it had been true the Danforth case would have been impossible. Is it true when an officer of the deck demands the employment of a force of men from the engineer's department to scrub decks, in opposition to the remonstrances of the engineer in charge, as has been done? Is it true when a captain orders a chief engineer to limit the consumption of coal to a quantity absurdly insufficient to carry out a previous necessary and legitimate order as to the ship's readiness to move at full speed, and to insist upon it after remonstrances and explanation by the chief engineer to the effect that it would render impossible the carrying out of the previous order—as happened to the writer—merely because this captain insisted that he was "captain of the ship, and proposed to be obeyed"?

Then, if it were true, would Captain Mahan think it a desirable thing that a machinist, however competent as such, be supreme in the engine room, to be "as absolute as the captain" in his sphere? The truth is, that with a competent commissioned engineer on watch—not a machinist or any person who could thus be consistently designated—permitted to be as absolute as the deck officer of the watch, each in his sphere, nine-tenths of the troubles of the navy would disappear; and it is exactly because these conditions have never yet obtained upon a single vessel of our navy that the constant contention between the line and engineer corps has existed.

Now, as to the question of rank and title: As I have said before, it is nothing to us what they do in this connection in other navies; although the signs of the times indicate that this matter is undergoing change in all of them. It is the American Navy we have to deal with, and because the naval authorities of some monarchial governments have not yet discovered the engineer's place in their marine economy, that is no reason why we should blind ourselves to the real conditions.

All navies do commission engineers, and in various proportions. If it is only a question of degree, and not of kind, we have a right to consult our own necessities and the genius of our institutions, the more nearly to conform our military establishments to them.

Captain Mahan says: It is "preposterous to line officers that the titles of the line are in some way essential to the authority and dignity of engineer officers;" that "the republican idea knows nothing of titles, except as convenient names which designate duties. . . . An engineer is called an engineer because he has to do with engines; to call him a lieutenant simply obscures his functions. . . . The engine is a new-comer; it has brought its own nomenclature, including those who run it." Then why want to call the man in charge of the engine room watch a machinist? Admiral Walker says that the man who "has to do with engines" on shipboard is only an "engine driver." Does the title of machinist designate *his* duty? Does the title of lieutenant designate duties when an officer of that grade commands a small vessel, as is often the case? Do the titles of captain, colonel, major or what not in the army designate duties? Do they in any way indicate whether the holder is an engineer, a cavalryman, an artilleryman or of the infantry? Do these titles at all designate the duties of the staff in the army? Is a captain, major or colonel in the medical corps or the commissariat of the army designated as such by the military title he bears? Or is there some divinity hedging the military titles of the navy which places them beyond the reach and hope of ordinary mortals? These people know well enough that the names, engineer, cavalry, infantry, artillery surgeon, paymaster, etc., in the army designate the corps merely, and that the officers in each have exactly corresponding rank and titles, by which they are addressed and known, each in his grade, irrespective of the branch to which he may belong.

Why not, then, Lieutenant Doe, Assistant Engineer U. S. N., as well as the corresponding army grade of Captain Doe, Surgeon U. S. A.? Why not Captain Roe, Chief Engineer U. S. N., as well as the corresponding Colonel Roe, Paymaster U. S. A.? Why not Commodore Blank, Engineer-in-Chief U. S. N., as well as the corresponding Brigadier-General Blank, Surgeon-General U. S. A.? To all these queries there is but one answer: There is no reason, except an unworthy jealousy of all honor and distinction not coming to themselves, among the line of the navy; and it is a sad commentary upon the personnel of the line of the navy, as involving this question of rank and title, and exhibits the great stress that corps is under in this matter, when such a man as Captain Mahan can be brought to so far belittle his grand record as to stoop to such transparent special pleading as I have above quoted from him.

Whatever "the republican idea" may not know of titles, it certainly does know that in either army or navy they are given to designate rank, but not duties, which in its turn designates a scale of honor which is supposed to recognize the recipient's acquirements and achievements in his particular sphere; but that they are descriptive of, or in any way designate professions or duties, is as far from true as that they designate stature; and no one has greater cause to know this than Captain Mahan himself.

In reply to the last two contributors to this symposium, little need be said. The animus so clearly exhibited by them ought to be beneath anyone who wears the livery of "Uncle Sam." As the third contributor to this series does little more than exploit his own magnificence and importance while lately on duty in command, and devotes what remains to an ineffectual attempt to imitate the present talented engineer-in-chief in word-picturing, his article may be dismissed without further comment.

The first paragraph of Lieutenant Staunton's contribution might justly decide every self-respecting engineer to treat it with the contempt it deserves; but, as there are some things following which, perhaps, it would not be well to leave unnoticed, I will refer to one or two of them.

The lieutenant says: "Under their [the line officers'] sole direction and guidance has been developed the manufacture of steel, urged on by an ascending scale of requirements to the highest results, the manufacture of armor which has led the world, all ordnance and torpedo engineering, electric engineering in its application to ship's lighting, search lights and motors on shipboard, and the complicated systems of interior communications," and a lot more of similar import; and all this these people would have us believe, in this specializing age, they may and have become proficient in, as replacing what they have necessarily lost in the mere management of sail power; since they still require all the rest of what before went to make up the military seaman.

Now, the true inwardness of all this is, that in nearly all the matters mentioned, line officers have been detailed to duties in which they were not and could not be proficient, and which would be legitimately and always have been performed elsewhere by engineers. The results of this have been most disastrous to the country, as witness the well-justified public outcry against inefficient inspection of steel and other engineering materials used in naval construction.

These line officers have been forced into this duty to make places for members of their own corps and to prevent the engineers from becoming proportionally too numerous; and no part of the performances of the line in this connection has been more indefensible and unreasonable than their continued assumption of duties for which they had not been equipped, for the sole purpose of crowding out those who were.

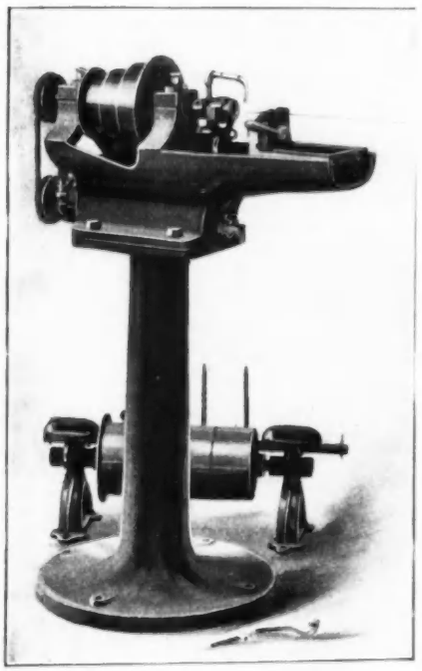
On the modern war vessel, as on the merchantman, the engineer should be in charge of everything which falls within the province of an engineer or the pro-

fession of engineering, and for which he is presumably fitted and equipped by education and experience. The inspection of steel or other engineering material by line officers is a solecism such as would not be tolerated in any occupation in civil life; and it never would have obtained in the naval service except to provide places for a class of officers whose proportionally required numbers had become less through the logic of events.

In his attempted elucidation of the difference between an engineer and an "engine driver," this writer says: "The functions and positions of engineers and engine drivers (mechanicians) should not be confused. The navy in commission and ready for service—the military marine—has to do only with the second class." What, then, of that confessed necessity, the highly educated chief engineer? Is he also an "engine driver"? It is no less than laughable how these people cast about for some cognomen for the watch engineer at sea which shall not carry with it some prestige or importance too nearly approaching what they conceive as peculiarly their own. Lieutenant Staunton is evidently not quite satisfied with that of machinist, and discovering, no doubt, its incongruity, ventures upon that of "mechanician." Well, a watchmaker is a mechanician, but he would make sorry work of having to do with engine room watches at sea.

The fact is that this whole business of striving to designate the engineer at sea by some title which must not by any chance lead the world to regard him as in any way comparable to the line officer in status, is an exceedingly little one, and quite unworthy of a class of officers such as should constitute the line of the United States Navy. The people have a right to look for something better, more manly, than their constant endeavor to hold the service down to the dead past through this sort of official persecution of an equally deserving and important branch. We hear of nothing like it in the army, where line and staff are alike titled, ranked and honored. When similar conditions shall obtain in the navy, and not till then, there will be that internal peace which reigns in the land forces of the nation. So long as the line of the navy keeps up its self-sufficient efforts to minimize and suppress the reasonable and legitimate status of the staff corps, there will continue that disorganizing, disintegrating strife which has cursed the navy for so many years past.

The writer resigned from the service as long ago as 1869, perhaps for its good, but has always kept in touch with its affairs. He left it for the then sole reason that he refused to go to sea, as chief engineer, with three of his commissioned assistants assigned by the commanding officer to quarters which properly belonged to warrant officers, and greatly inferior to those assigned to an equal number of young line officers of lower rank than they. This matter of quarters was long contested by the line until they were forced to retire from their untenable position. Ever since this settlement the line has pursued the junior engineer officer at sea with a vindictive determination to eradicate him from the service, and thus settle the matter of precedence and quarters in an indirect way. They reason that the "engine driver," "machinist," "mechanician" or "artificer," could, of course, look for no such distinction as is conveyed in a commission; hence, he would not be entitled to anything better than a hammock and every environment of a man thus quartered. In this way they have exhausted the vocabulary of our language for some designation for the person in charge of the engine room watch at sea, which would carry with it nothing of the distinction or honorable regard due to the watch engineer or junior engineer.



BICYCLE SPOKE THREADING MACHINE.

Whether or not it was to the advantage of the navy that the writer left it, nothing is more notorious than that the service has been most seriously crippled by the constant and numerous resignations of engineer officers whom the service could least afford to spare; they leaving rather than submit to the contumely and humiliation constantly heaped upon them by the followers of Admiral Walker's "great art." And these ex-engineers are to-day, with scarcely an exception, filling positions of honor and trust and responsibility, which even that of a line officer of any grade does not surpass.

It is greatly to be hoped that Congress will speedily pass the Squire-Wilson Bill, or some other measure which will serve to rescue our modern ships from the emasculation which threatens them and the service to which they belong.

JOHN T. HAWKINS,
Late P. A. Eng., U. S. N.

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Bicycle Spoke Threading Machine.

The accompanying engraving represents a new bicycle spoke threading machine recently placed on the market by the Geometric Drill Company, of New Haven, Conn. The machine, however, is not confined wholly to threading bicycle spokes, as it can be furnished with suitable equipment for other kinds of thread-cutting, ranging in size between No. 17 wire and $\frac{3}{8}$-inch, inclusive. As arranged for threading bicycle spokes, it has a capacity of from $\frac{5}{16}$ inch to No. 17 wire gage inclusive.

As will be seen, the machine is simple in construction, and is fitted by the manufacturers with their self-opening and adjustable die-head, which was fully described in a recent issue of this paper. It is also equipped with an automatic oil pump, which insures a sufficient flow of oil at all times; the bed of the machine serving as an oil tank or receiver.

The vise for holding the work while being threaded is arranged with a hand-lever, which is controlled by the left hand of the operator. A slight downward movement of this lever closes the jaws of the vise securely on the work, and at the same time the slide is pushed forward, bringing the work in contact with the threading dies. The thread is cut almost instantly when the dies spring open, automatically releasing the thread. The operator then draws back the slide, and at the same time gives a slight upward movement to the hand-lever, which opens the holding jaws and allows the work to drop out. As the slide is drawn back, the threading dies are automatically closed by means of a simple attachment provided for the purpose, and which is connected with the slide by a small rod and adjustable stop collars. The left hand of the operator is employed in moving the slide back and forth, and in opening and closing the holding vise, both of which are accomplished with one lever. This leaves the right hand free to feed the machine, and consequently admits of very rapid manipulation.

The machine is usually furnished with an iron column, as shown in the engraving, but can be furnished for bolting to the top of a bench, if preferred.

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Since the publication, in our issue of January 21st, of our review of Mr. Frank M. Bennett's book called "The Engineer in Naval Warfare," we have received several inquiries for the publisher's address. It is—Warren & Co., 416 Wood street, Pittsburg, Pa.

Centrifugal Force and Inertia in Governors.*

BY FRANK H. BALL.

Let Fig. 1 represent a governor wheel or disk fixed on a shaft S, with which it rotates. Let M represent a mass pivoted at P by a connecting arm. The rotation of the wheel in either direction will cause the mass M to move outward, because its inertia resists the circular path or the radial acceleration, and this accelerating force is familiarly known as *centrifugal force.*

Referring now to Fig. 3, let the same mass M be considered as pivoted on the shaft by a connecting arm, and free to revolve around the shaft. Centrifugal force in this case is directly resisted by the pivot, and therefore produces no motion of the mass about the pivot. Any change in the rate of rotation of the wheel, however, will not be participated in by the mass M without a force developed in the direction of the arrows, because of the inertia of the mass M, and this force we will call *tangential accelerating force,* which corresponds with what Mr. Rites has called "tangential inertia."

Assuming the mass M to be concentrated at its center of gravity and the arm to have no weight, then in Fig. 3 the only accelerating force capable of producing motion of this mass around the pivot is what we have called *tangential accelerating force.*

Fig. 4 is supposed to represent the same wheel shown in Figs. 2 and 3, with a mass M equal to the mass M in Figs. 2 and 3 and pivoted as in Fig. 3; but the mass, instead of being concentrated at its center of gravity, is assumed to be distributed in the form of a bar as shown, with its center of gravity remaining as in Fig. 3.

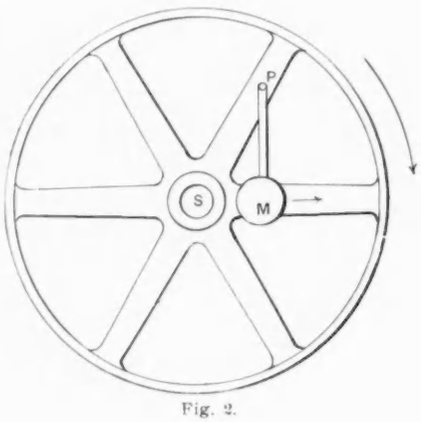

Fig. 2.

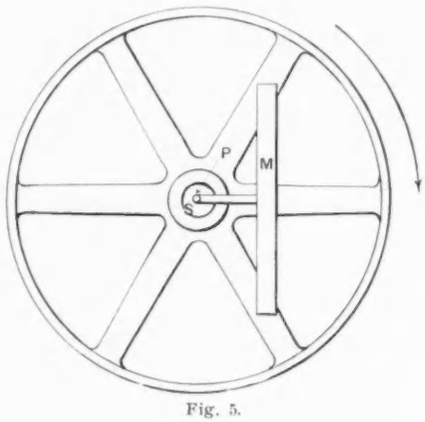

Fig. 5.

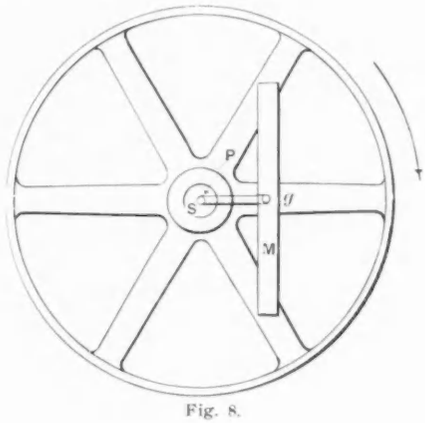

Fig. 8.

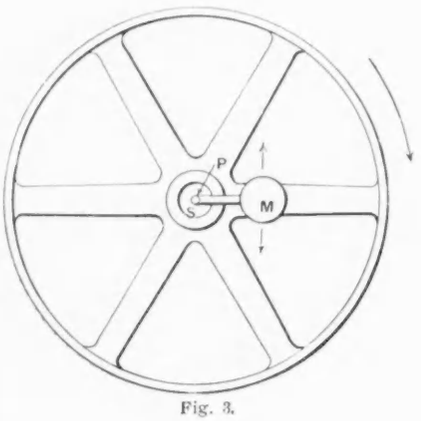

Fig. 3.

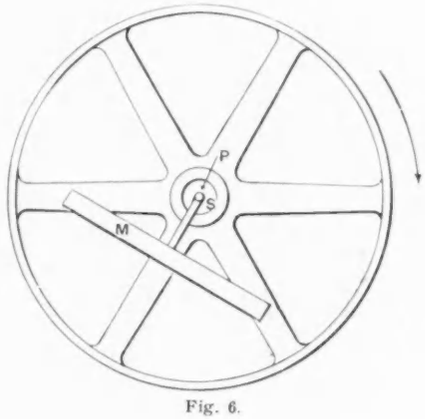

Fig. 6.

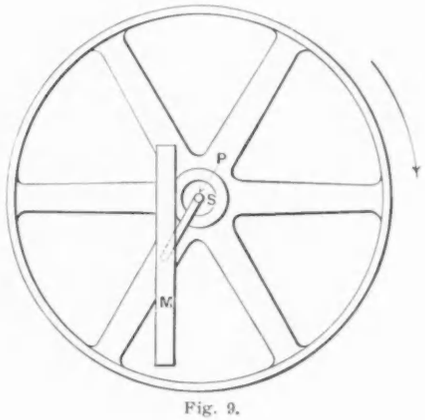

Fig. 9.

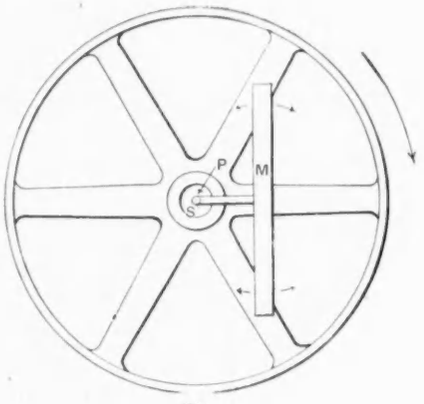

Fig. 4.

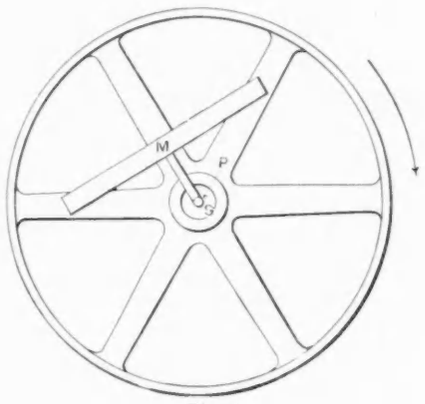

Fig. 7.

Fig. 10.

CENTRIFUGAL FORCE AND INERTIA IN GOVERNORS.

* From a paper entitled "Steam Engine Governors," read at the December meeting of the American Society of Mechanical Engineers.

This construction, like Fig. 3, carries the centrifugal force on the pivot without producing rotation about it, and, like Fig. 3, *tangential accelerating force* is a prominent force to produce pivotal rotation.

Another accelerating force appears in the construction of Fig. 4, to which Mr. Rites has called special attention in his paper referred to, and which he calls "angular inertia," but which is perhaps better described by the term *angular accelerating force*, because inertia does not seem to be an appropriate name for a force.

The magnitude of this force depends on the distribution of the mass M with relation to its center of gravity. Under the assumed condition of this mass M in Figs. 2 and 3 no *angular* acceleration appears, but in Fig. 4 it becomes a pronounced force, and may be described as the effect of the angular acceleration of the mass about its own center of gravity.

To make this perfectly clear, refer to Figs. 5, 6 and 7. Each of these figures is assumed to represent the same wheel shown in Fig. 4, and the same mass M pivoted as in Fig. 4.

Rotation of the wheel and mass M in the direction indicated would result in the successive positions of the mass M that are shown, and it will be seen that, while rotating around the shaft S, it also rotates around its center of gravity.

To illustrate this further, suppose the bar or mass M is pivoted at its center of gravity G (Figs. 8, 9 and 10). Rotation of the wheel and mass may now take place without rotation of the mass around its center of gravity.

Figs. 8, 9 and 10 represent such a condition, because it will be seen that the bar remains in a vertical position, while its center of gravity rotates with the wheel around the shaft S.

Comparing Figs. 5, 6 and 7 with Figs. 8, 9 and 10, it will be seen that the pivoted bar of the latter does not necessarily have angular rotation about its center of gravity, while the former necessarily has it, and for each complete rotation of the wheel the bar has passed through 360 degrees of rotation around its own center of gravity.

A familiar illustration of the same idea is found in the relation of the moon to the earth, the latter rotating once on its axis while completing its passage once around the earth in its orbit, which causes the same side of the moon to be continually toward the earth; whereas, if the moon had no axial rotation its entire surface would be successively exposed to our view as it passes around the earth.

From the foregoing it is clear that three accelerating forces are available as actuating forces in a governor. The most important, because of its being absolutely indispensable, is centrifugal accelerating force, or centrifugal force. Either or both of the other two may be utilized as governing forces, or they may be inoperative, or may actively oppose the governing motion, and thus become an obstruction. To assist in governing, they must act *with* centrifugal force during an increase of the rate of rotation, and *oppose* centrifugal force when rotation is decreased.

The three accelerating forces we have been considering may each be developed by a separate moving part, or all three may appear in a single moving part. The latter plan is looked upon with more favor because of its simplicity and fewness of parts.

▲ ▲ ▲

Principles and Policy of the "American Machinist."

A considerable portion of the work connected with the management of the editorial department of a technical journal is caused by the fact that so many people think they have some sort of a claim to special consideration, and seem to resolutely shut their eyes to the fact that the editor of a successful technical journal must consider first and above everything else his readers, and that for him to publish proffered matter, descriptions of machines, etc., solely because the writers or others interested wish it so, would be absurd and ruinous.

We had been thinking of again and more fully stating our position in regard to these matters, but now find in our contemporary, the "Engineering News," the case so well stated that we prefer to quote from its article, believing that the statement ought to have all the more significance from the fact that this well-known and highly esteemed journal finds the conditions necessary to maintain its standing essentially the same as we find them in our own experience. The "Engineering News" aims to cover the whole field of engineering, while we are devoted to a particular branch of it; but this aside, the same principles apply in the conduct of both papers. We abstract from the article in question as follows:

" * * * We are frequently asked [our contemporary remarks] whether an article on this or that subject is 'in our line.' The answer is that all articles on subjects connected with any department of engineering are directly 'in our line,' and whether they will be acceptable or not depends solely on the editors' judgment as to their interest and value to the readers. All such contributions, from any source whatever, the editors are always pleased to receive. They are examined as soon as time permits, and such as are found unavailable for use in any form are returned to the senders where such a return is requested.

"An opinion as to whether an article on a given subject is likely to prove available is given on request; but the final acceptance of an article can in no case be made until the complete manuscript with illustrations, if any, is submitted.

"In general, the receipt of matter offered for publication is not acknowledged, unless this is especially requested. Losses in the mails are so rare that it is not deemed worth while to incur the additional labor of such acknowledgment.

"In the case of contributions found unavailable and returned to the sender, the editors have found it impossible to state by personal letter the reasons which influence their decision. A printed letter accompanies such manuscripts in which it is explained that the return of the article does not necessarily imply that it is lacking in merit or interest, as the amount of matter offered for publication is so large that a rigid selection has to be made and many articles of merit have to be returned.

* * * * * *

"What has been said with reference to the offer and return of articles above, applies, of course, especially to papers which are submitted for publication and for which their writers expect compensation; but the general principles apply also to all classes of matter sent to us. We are frequently asked, for example, what our position is with reference to what are commonly known as 'trade write-ups.' The same rule applies to this as to other matter, that the first consideration is the interest of our readers. We fully recognize the fact that outside what is commonly known as 'civil engineering,' the great bulk of the engineering work that is carried on in this country is done by manufacturing firms. It is to these that we have to look chiefly, therefore, for a great deal of matter of interest and practical value to the engineers; and we welcome contributions from such firms on the same basis as those from any other source. If a manufacturer has a new machine or device of interest to engineers, and will furnish us such drawings and particulars concerning it as will enable an engineer to form a judgment as to its merits, we can often prepare an article from it that will be of great practical value to many of our readers. On the other hand, the manufacturer who sends us a cut of a machine which shows nothing except what a wood engraver imagines its external appearance might be, and a so-called description which, in reality, is only a string of vague generalities concerning what he considers its merits, has no cause for complaint at our decision that such matter is not of sufficient interest to our readers to warrant us in giving it space.

"A department of this journal which we believe is much appreciated by our readers is that of 'Letters to the Editor,' and its development during the past two or three years has been a source of much gratification to us. We intend this department to be a place for the open discussion of any and all matters of interest to engineers, and it is our intention to conduct it with entire impartiality, and to permit free expression of contributors, whatever their views or opinions may be,

provided their letters come under our rule above stated, i. e., that they are matter of interest to our readers.

* * * * * *

"In the case of such a discussion we expect those taking part to observe the usual courtesies of debate and to refrain entirely from personalities.

"Contributors either to this or other departments of this paper are at liberty to veil their identity under a nom-de-plume if they choose; but in writing to us, must give their real name; otherwise the waste basket yawns for their contributions.

"We sometimes find some misapprehension as to the degree to which the editors assume responsibility for the matter published in various departments of the paper. While the matter published on the editorial pages, and, in fact, all matter not signed or credited to some source, may be understood to be prepared by the editors; the contributed matter and the matter taken from the proceedings of engineering societies represents the views and opinions of those to whom it is credited, and not necessarily the opinions of the editors. Of course, all such matter has been examined by the editors, and has been judged by them to be of sufficient interest to be worth publication; but it does not follow that they approve or agree with the ideas or opinions which the writer may express. In the department of 'Letters to the Editor' especially, it is our aim to give a fair field to all who have something to say that is worth saying, whether it coincides with our opinions or not.

"In thus defining the extent to which the editorial responsibility extends, we should not be misunderstood as magnifying the importance of the editors' opinions. The editors are well aware that they are far from infallible, and that they, like the rest of mankind, are prone to err. In fact, they are probably better aware how far their work falls short of the standard which they have set for themselves than are any of their readers. But they are at least conscientious in adhering to the principles they have laid down of impartiality and constancy to the interests of their readers and of the profession which it is the aim of this journal to serve.

* * * * * *

"We are aware that some of our readers pursue the practice of cutting from the paper such articles as are in their especial line, which they file on some system or other, and throw away the remainder of the paper. Perhaps if a man were absolutely sure that he would follow a particular specialty all his life long and would never have need of information on any other department of engineering work, this would be a good course to pursue; but very few engineers can map out their future in that way. Ten years ago thousands of engineers were devoting all their attention to steam railway construction. To-day, nine-tenths of them are in other fields of engineering work, and it is quite safe to say that those fared the best in making the change who were the best equipped for these other lines of work and who had kept in touch with them so far as possible during their work on railway construction.

"We would advise our readers, for their own interest, to preserve and bind their files of this journal. The time is very likely to come when the information they can find in its pages on other departments of engineering than that on which they are now engaged, will be of the greatest value to them. * * *"

▲ ▲ ▲

The Making of Chips.

BY TECUMSEH SWIFT.

We have had a great deal of profitable discussion from time to time about tools, but not so much as we should have had about chips, and I am very glad to note that the "American Machinist" is now giving some attention to the latter. This is simply getting down to common sense, and I would be glad to do a little, if I can, to help along the work on that level. No one could discourse intelligently or profitably about a piano or a violin without speaking of the tones produced, and neither can we properly speak of the tools of the machinist without also having much to say of the product of those tools, and the product of the tools is, after all, not what we call the finished piece of work, but rather the chips.

We should be careful now not to fall into the opposite error and find ourselves studying chips apart from the tools which produce them, for that would probably be less profitable than the other. Only a short time ago I was looking through one of our prominent steel works, and in the laboratory and record room of the establishment I was shown a great number of small bottles of steel chips, and the expert told me that samples of the chips were a part of the record of every test, and that he could judge very quickly and very accurately of the quality of the steel by those chips. Unfortunately, he said nothing about the tool by which the chips were made, so there he was at the other extreme. I must confess that I would have had much more respect for his judgment if he had just told me that he always insisted upon the same shape and setting of the tool, the same depth of cut and the same feed when producing those chips; but if he looked after those points he certainly did not mention them.

Now, the making of chips is not such a simple operation as some might perhaps think it to be. As every cause produces more than one effect, I am inclined to think that there is no such thing as a simple act or a simple mechanical operation, although we often hear of such things. When chips are being made, there are always at least two distinct operations going on. There is the severing of the chip from the solid body of metal operated upon, and there is the coiling or breaking-up, or otherwise getting the chip out of the way after it is severed.

It seems to me that what we are especially in need of to-day is a better realization of the great range of variable conditions affecting the second operation, and the effect of those conditions upon the cost of chip-making. The speed of cutting, the power required for driving and the endurance of the tool are more dependent upon the circumstances and conditions affecting the getting of the chip out of the way after it is severed than upon the actual severing of it.

This may at first be considered a rather extravagant statement, but I think it will not be difficult to get the average machinist to acknowledge the correctness of it if we consider for a minute a simple illustration. Say that we have a disk of mild steel, 12 inches in diameter and ⅜ inch thick, securely clamped and fastened between stout flanges, 6 inches diameter, and mounted in a strong lathe. We take a good side tool and set it with the cutting edge parallel to the lathe shears, and start to cut on the edge of the disk, feeding the tool in toward the center until the edges of the 6-inch flanges are reached, or until the disk is reduced to 6 inches diameter. This will be a case, pure and simple, of severing the metal from the stock, or as near a simple case as we are likely to get in practice. We assume that the face of the side tool will have little clearance, while the cutting angle will be decidedly acute, and the chip, with a little bending right at the line of severance, will flow away downward in an unbroken chip. No one needs to be told that in this case the metal will be cut easily and rapidly, and that the tool will wear slowly.

Say that we have again a good, stout lathe and a piece of the same mild steel, 12 inches diameter, mounted upon good centers with ample power to drive it. We suppose that it is short enough so that it will not spring under the cut that we want to take, or that, if long, it is steadied by a center rest near the cut. We now take a square-nosed tool ⅜ inch thick, and of the best-known shape for cutting, and we start to cut a groove in toward the center of the steel. The cutting of this groove from the outside 3 inches in, or to a diameter of 6 inches, will, of course, require the removal of as much metal in the form of chips as in turning the 12-inch disk down to 6 inches. We all know that in this case the making of the same weight of chips will require much more power and take much more time than in cutting the chips from the disk, and the principal cause of the difference will be in the greater difficulty and resistance that the chips will encounter in getting away.

I am aware that the comparison here is not quite fair, because the chips in the latter case have to be severed at the edges as well as for the ⅜ inch of cutting face,

but it cannot be claimed that the severing of the edges is the sole or the principal cause of the slowness of the cutting.

We can find another illustration which I certainly intend to be perfectly fair. This time we will try the planer. We take a steel plate ½ inch thick and clamp it down flat upon the platen, with a straight side of it overhanging, say, an inch, so that we can work at it comfortably. We now take a good side tool and set it vertical in the tool holder, and start to cut some shavings off the edge of the steel, taking cuts the whole thickness of the sheet at once. It is nice mild steel and it "cuts like cheese," as they say, only the expression is not a very good one, because the chips don't flow off like cheese at all, but more like, say, apple parings. We take off some nice thin ribbons at first, and then we take thicker ones, and the thicker the chips are the more power it takes to cut them, and if we go on increasing the thickness of the chip we soon find the full strength of the planer, and if we try to cut still thicker chips the planer is stalled and we are unable to cut at all.

Now, the curious thing about this experience is that the difference between the easy and the difficult cut, or between the possible and the impossible cut, is in the ease or difficulty of rolling away the chip, or in the possibility or the impossibility of rolling it away, and not at all in the difficulty in severing it from the stock. The latter must be identical in either case. The tensile strength of the material is the same all through; the same at a depth of a hundredth of an inch, where a thin chip would be severed, as at an eighth of an inch deep, where a thick chip would be severed. We here get a great difference in accomplishment that is due entirely to the difference in the thickness of the sections to be separated from the mass, and to the fact that there must necessarily be a change in the shape of the part as it is separated to enable it to get out of the way of the tool which it must pass, the thinner section more readily allowing this necessary change of shape than the thicker section can possibly do.

The actual thickness of the chip is not the only condition that may affect its ability to get out of the way. There is, for instance, a great difference in the chip-producing ability of tools of different shapes, on account of other conditions than merely the chip thickness. The greatest of all the chip-producers is probably the diamond point, or its equivalent under various disguises, on exterior cylindrical work, and the most handicapped of all, and the one most deserving of our sympathy, is the V-thread tool. It is quite a common thing, or, indeed, the usual thing, for one of these tools to be able to show a hundred times or a thousand times as much chips as the other for a single grinding. With the diamond point the chip has a reasonably good chance to get out of the way. It is almost the only lathe tool that we use that can make and is expected to make a continuous chip. The chips from other tools are so distorted in getting away that they almost invariably are broken up into small fragments. Probably there is no better evidence of ease of cutting than the continuous chip where the material is such that it may be expected to hold together.

No one expects the chips cut by a V-thread tool to roll out in continuous ribbons, and the reason is that the chips shaved off from the opposite sides of the thread crowd against each other and prevent either from flowing out continuously. Starting in with a V-thread tool upon a finished cylindrical surface, the first thread cut would be solid, and triangular in section, and it might be expected to roll out continuously if the top of the cutting tool had a suitable rake; but with the succeeding cuts, the continuous chips would be practically impossible under any conditions. The chip from either side might flow perfectly, were it not joined to and opposed by the chip from the other side. Much time is gained in cutting V-threads, if of size and length sufficient to pay for the resetting of the tools, by cutting upon one side of the thread only, instead of upon both sides, and thereby giving the chip a chance to flow away without a constant struggle with the opposite chip. In this case the thicker chip is cut with much greater ease than the thinner, on account of the freedom of its exit.

The above is intended merely as a suggestion of a line of thought and investigation that has perhaps not yet been sufficiently traversed.

▲ ▲ ▲

Roller Keys.

The accompanying cut, which we reproduce, somewhat reduced in size, from "Engineering," London, will be of interest to our readers, as it adds something to the discussion of methods of wheel-fastening which not long ago ran its course in our columns. The mode of securing the wheel as shown in the cut has been introduced in England by the Southgate Engineering Company.

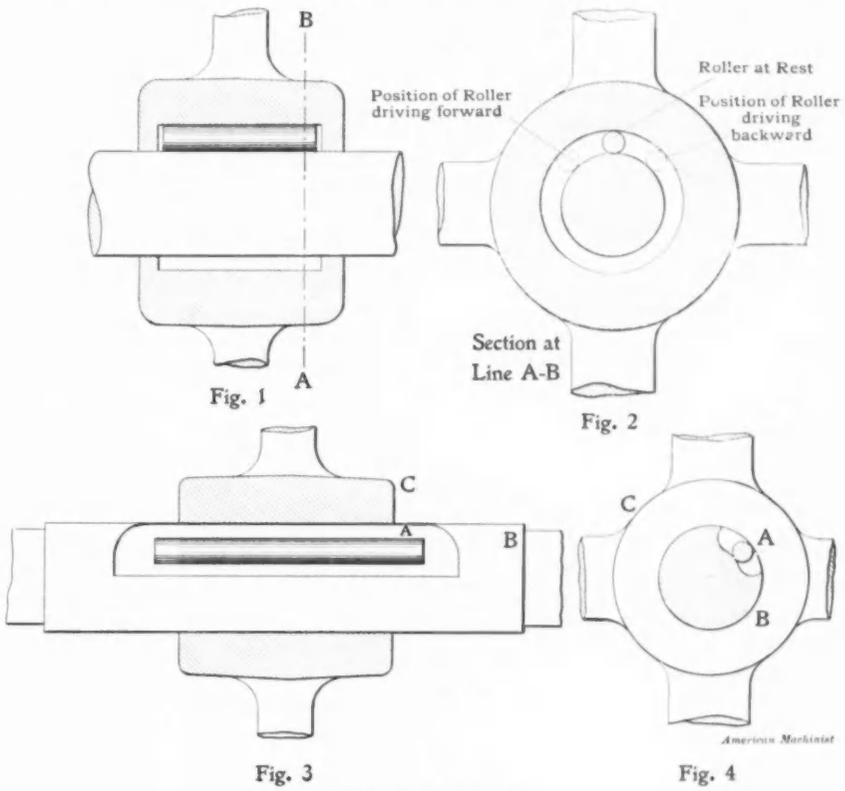

Fig. 1 Fig. 2

Fig. 3 Fig. 4

ROLLER KEYS.

In Figs. 1 and 2 there are concentric outer lips to the hole, which are bored to fit the shaft, and an eccentric central chamber in which is placed a roller which, when the wheel turns upon the shaft in either direction, acts to tighten it. The wheel, when tight, will be gripped by the concentric edges of the hole on one side and by the roller upon the opposite side, the surfaces in contact seeming rather insufficient for the work expected of them.

In Figs. 3 and 4 the entire hole is bored to fit the shaft, and then a slot is cut upon one side of the shaft, the bottom of the slot not being concentric. The roller is placed in the deeper side of the excavation, the wheel is slipped over it, and when turned around a little, the roller tightens it securely. Turning the wheel in the opposite direction will, of course, free it again.

"Sleepy Eye" Patent Examiners.

The notoriety attained by the Sleepy Eye rotary engine, on account of the announcement of its recent alleged sale by the inventor to a British syndicate for a fabulous sum, has led us to believe that we are warranted in calling the attention of our readers a little further to the matter. We have before us the specification and drawings of Grant Brambel's patent for rotary engine, issued December 3, 1895. There will be no difficulty in catching on to the idea of the invention.

In Fig. 1, which is reproduced from the patent drawing, the hand lever with the notched circular guide operates a three-way valve used as a throttle and reversing valve. When the lever and valve are in the position shown in the drawing, there is no admission of steam to the engine. When the lever is thrown over to the right, as indicated by the dotted lines, the steam is admitted to the right-hand passage, and it is asserted that the central piston and its shaft will then turn in the direction indicated by the arrow. If the lever were thrown over to the extreme left, it is asserted that the engine would run in the reverse direction. There can be no question that it would run equally well in either direction.

But would it run? If the piston were placed in the position shown in Fig. 2, it is just barely conceivable that if the throttle valve were opened quickly, the sudden inrush of steam striking against the face *a* might have a tendency to turn the piston in the desired direction. Anyone familiar with the operation of steam would know, however, that upon the admission of the steam the filling of the pocket *a c b* would be practically instantaneous; the pressure against *a* would be exactly equal to the pressure against *b*, and the rotative effect upon the one in one direction would be exactly balanced by the rotative effect against the other in the other direction. At the same time, the pressure of the steam upon the circular surface *c* would press the entire piston with great force against the opposite wall of the case, holding it as in a vise, and the piston could not possibly rotate. The simple fact is that a, let us say, "sleepy eye" patent office examiner allowed a patent for a rotary engine which is not a rotary engine at all, but an absolutely inoperative device.

Suppose that at this moment some intelligent inventor with a meritorious invention, and represented by an honest attorney, has an invention which he knows must be acted upon by this same examiner, what must be the feelings with which they must regard him?

The angular pocket *c* in the case is called an expansion chamber, and it is assumed that the expansion of the steam in this chamber operates to rotate the piston. The expansion might perhaps operate in that way, only there is no expansion. From the time when communication is opened between the pocket *a b c* in the piston and the "expansion chamber," which occurs just after the piston passes the position shown in Fig. 2, until communication is closed when the position of Fig. 3 is reached, there is no enlargement of the chamber, and consequently no expansion. The "sleepy eye" examiner, however, evidently did not see it.

As we said above that a patent office examiner had allowed a patent upon an inoperative device, it may be proper to qualify that a little. In addition to the

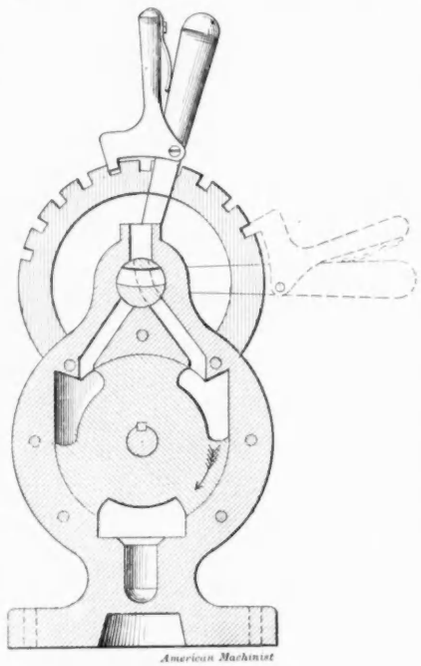

Fig. 1

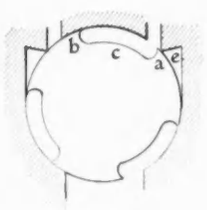

Fig. 2

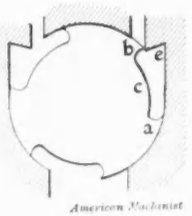

Fig. 3

THE SLEEPY EYE ROTARY ENGINE.

essential features of the invention that we have referred to, there are others which need not be shown in detail, but which are embraced in the one comprehensive combination claim, and whose omission in the construction of the engine would involve a departure from the claim and leave the invention entirely unprotected. If certain oil passages particularly specified in the claim were omitted or essentially changed in the construction, there would be absolutely nothing of the entire alleged invention which the claim would hold. The "sleepy eye" examiner, after all, did not allow "a worthless patent upon a worthless invention," for he practically allowed no patent, or protection, at all.

The issuance of such a patent as that of the Brambel rotary engine is only possible by the co-existence of an inventor, a patent agent and a patent office examiner, neither of whom is an ideal of his class. By putting it in this way we may avoid the use of all unpleasant adjectives and still convey our meaning. The use of adjectives is largely a matter of taste, and tastes differ.

And this patent, they say, was sold to a British syndicate for $7,100,000, with the rights for Mexico and Canada still undisposed of!

The latest and most reliable information in the matter is that Grant Brambel has not sold his engine. As he certainly has nothing salable, it is not easy to see how he could have sold anything.

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A Tragedy of the Engine-Room.

An exceedingly interesting story is told by a delegate from New York City to the National Marine Engineers' Convention, now in session in this city. The chief engineer of the ill-fated "Commodore," which was wrecked off the coast of Florida several weeks ago, was an active member of the New York City local organization. He was a young man of good character and ability, and his love of adventure induced him to offer his services to the Cuban Junta. His services were accepted, and he was ordered as a chief engineer of the "Commodore." Against his protest, an assistant was assigned him whom he knew nothing about, and who had not belonged to any local marine engineers' association. Upon the pretext of being ill, the assistant engineer of the "Commodore" shirked work for several days before the ship went to sea, so that when the vessel took her departure, the chief engineer was practically exhausted, there being only two mates and two engineers in the list of officers.

"After the 'Commodore' left harbor," says the narrator, "the assistant engineer, upon the plea of continued illness, kept the chief on watch for the greater part of the day. At midnight, after leaving port, the assistant volunteered for duty, and when things were turned over to him, everything about the machinery was working well. The chief engineer had thoroughly tested all the pumping appliances before leaving harbor, and they were found to work excellently. Particular attention had been given to the adjustment of the inspirators for clearing the bilges of water.

"Within two hours from the time the chief engineer had been relieved, he was awakened by one of the firemen, who told him that the ship was sinking, and that practically everything in the engine-room had become disabled. The chief immediately went to his station, and found that the assistant engineer, who had been a beach-comber and an ex-convict, and whose services had been secured because

they could be obtained cheaply, had practically wrecked the machinery.

"After a vain attempt to put things to rights, the vessel was abandoned, the deck officers taking to the boats, and the engineer force being left to find safety on a raft. The captain of the 'Commodore' gallantly stood by the raft, and after battling with the storm for thirty hours, reached one of the Florida keys, but in the attempt to effect a landing from the raft, all of the engineers' force were lost.

"While the raft was being towed, the men from the captain's boat carefully kept watch over it, and a short time after the crew left the vessel, a scuffle took place on the raft, which resulted in the chief engineer and one of the firemen throwing the traitor into the ocean.

"It is unnecessary to state that the leaders of the Cuban Junta have now learned at a great cost that not only ability, but integrity and character are required even in the engine-rooms of filibustering steamers.

"Weakened by continuous work and exhausted by his duties in charge of the raft, the chief engineer of the 'Commodore' lost his life in the surf in attempting to make a landing. His comrades in the New York Association of Marine Engineers, in connection with friends of the Cuban cause, propose to make some substantial recognition of his excellent services in fitting out the 'Commodore,' and his pluck in sealing the doom of the traitor who had betrayed his ship.

"The belief has too long prevailed that the mate in charge of the deck can undertake to supervise the work of the engineer officer below. The unfortunate fate of the 'Commodore' will probably be a practical object lesson to the naval officials of even great nations, in teaching them that naval warfare has greatly changed during the past decade, and that the man below, as well as above the protective deck, is an important factor."

The marine engineer delegates from New York City declare that the story as told above was from the official statement as furnished by President Palma, of the Cuban Junta in New York City. The committee of New York marine engineers distinctly told him that the organization would boycott every filibustering steamer starting from the coast unless the exact facts in regard to the death of Chief Engineer Hartigan were furnished them.

The story has never been in print, and from the earnestness and sincerity of the Cuban leaders, the New York engineers are convinced that the tale is a true one. —"Evening Star," Washington.

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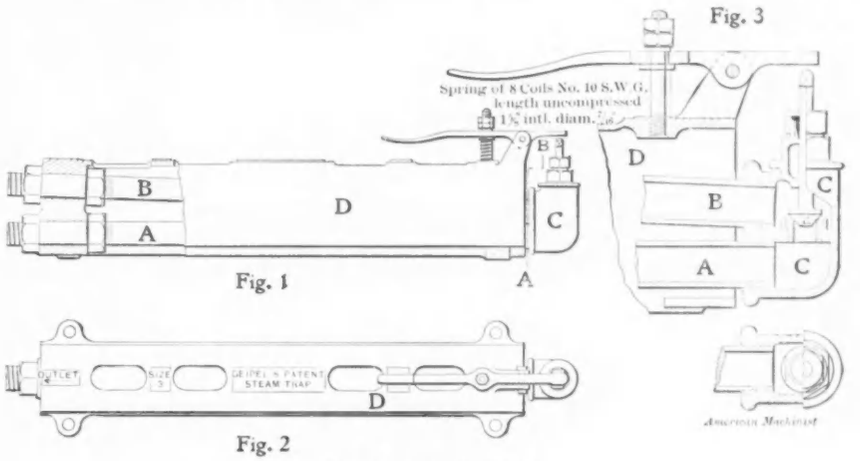
By a mischance, the signature of the author of the article printed in our issue of January 28th, entitled "Concerning Gages," was omitted. It was written by Mr. E. T. Adams, of Ithaca, N. Y.

A Novel Steam Trap.

The illustrations show a novel form of steam trap which is being introduced. The trap is simply for discharging the water of condensation from steam pipes, wherever it may be desirable to do so, and at the same time prevent the escape of steam. Fig. 1 is an elevation of the apparatus, partly in section; Fig. 2 is a plan, and Fig. 3 is an enlarged vertical section of the most essential portion of the apparatus. The shell *D* is made solid at the left-hand end and is open at the right-hand end. The inlet pipe *A*, which is of brass, is firmly attached to the shell *D* by the nuts upon the pipe inside and outside the shell. The outlet pipe *B*, which is of iron, is also firmly attached to the shell *D* in the same manner. These pipes, which are some distance apart vertically at the left hand, converge towards the right-hand end where they are quite close together and are firmly fixed in the valve head *C*. The normal position of the parts, or the position in which they would stand when everything was cold, is as shown. Here it will be seen that if sufficient water should accumulate in the pipe *A*, with even a very little pressure in the pipe, the valve would rise and the water would flow out through the iron pipe *B* and be discharged. This would continue as long as any water remained in the pipe to be discharged. As soon, however, as the steam began to follow the water, the brass pipe *A* would be heated, it would expand faster than the iron pipe *B*, and the attached head *C* would rise bodily until the stem of the valve *a* came in contact with the overhanging end of the lever *e*, and then the valve would close and no more steam would escape. The head *C* would not fall, and the valve *a* would not open again until the pipe *A* cooled off and contracted on account of the accumulation of water again. On the other end of the lever *e* there is a stud with adjustable nuts above the lever and a spring below it. The spring is provided so that the lever will be able to yield a little, if necessary, when the valve stem rises against it. The spring also makes it possible, by pressing down on the long end of the lever, to allow the valve to open and the steam to blow through. The valve may be examined at any time by unscrewing the valve-stem guide. The valve seat is renewable and there are no other working parts.

The apparatus works well at any pressure, having been used up to 300 pounds. It has had great success in Europe, and is used by the British Admiralty for high-pressure steam, and also in public buildings heated by exhaust steam. It is known as the Geipel trap, and is being introduced by Thorpe, Platt & Co., 97 Cedar street, New York.



A NOVEL STEAM TRAP.

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One of the earliest overhead traveling cranes with which we were acquainted, was located at the old Delamater Iron Works, of this city. The crane was an old-style machine, driven by a flying rope; but it had one feature which we have been surprised to see largely drop out of sight. We refer to the method of operating, which was by hanging ropes reaching to a point where they were easily reached from the floor. We believe there are many places where the wages of the attendant, who sits so contentedly in his traveling cage, do not give a fair return; and this old style of operating, by leaving him free for other duties when the crane is not being used, would give a far better return. We note with interest that Siemens & Halske, of Berlin, have revived this method of driving, having recently applied it to some of their electric cranes. While, of course, for heavy cranes, and those which are in fairly constant use, the traveling cage is preferable, there would seem, nevertheless, to be a considerable field for the hanging-rope style.

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On Thursday, February 11th, the examination for Engineer Inspector, Regulating, Grading and Paving, will take place, and those desiring to enter this examination should make application to S. William Briscoe, New Criminal Court Building, New York City.

Elaboration of Detail in Operating the Belleville Boiler.

The following, which we extract from an editorial in "The Engineer," of London, upon the recent highly successful trials of the Belleville boilers on the new ships "Powerful" and "Terrible," will be read with interest. It appears to make clear, what we have before intimated, that arguments for and against water tube boilers as a class by no means cover the case. Although the article is highly laudatory in tone, and no doubt deservedly so, it at the same time seems to suggest the question whether or not the success was really in the boiler or in the elaborate auxiliary apparatus and the high skill of the attendants. We extract as follows:

"Now, there are several methods of manufacturing steam, more or less old or well known. But so far, at all events as her Majesty's Navy is concerned, steam was made in quite a new way in these two ships. Instead of the rough-and-ready way with which most of us are familiar, steam was made with a scientific refinement of manipulation the like of which has probably never been seen before. The Belleville steam generator is not, in the proper sense of the word, a 'boiler' at all. It is a very peculiar and special piece of apparatus; none the worse for that, however. But it must be treated in a special way, and its peculiarities must be thoroughly understood. It has been said by a very competent authority that it has no circulation in the ordinary sense of the word, and that is, we think, true; but it has certainly an efficient substitute for circulation. Again, in most boilers it has been found sufficient to admit air, or blow it in, above the fire to keep down smoke, but something more than this is needed with the Belleville generator; and so we find a number of cunningly devised air compressors, dispersed in the boiler-rooms, which supply divers small jets, and so throw streams of air into corners and out of the way places among the tubes, and so there is flame produced, where, without these jets, there would be smoke and a heavy deposit of soot. Furthermore, as the Belleville boiler will by no means tolerate bad stoking, a special system of firing has been devised. In each fire-room is a clock with a peculiar dial, and by its aid fires are fed with the regularity of machinery, and with a discrimination which no machine can pretend to manifest. Like everything else, the feed pumps have been specially designed, and the regulation of the feed is all but entirely automatic. We have only to compare the method of manufacturing steam in an ordinary cargo boat with the refinements employed in the 'Powerful' and 'Terrible,' to realize how great a difference may exist between two ways of attaining the same end. When we speak of the success of the Belleville boiler, we must remember that the boiler could not have been worked to advantage, if at all, but for the skill and care displayed by those who had been intelligently educated in its use. The ordinary boiler is, compared with the Belleville generator, as a kitchen clock is to a chronometer. When we hear, as we do now and then, of the failure of such boilers, it will, in future be safe to say that the failure has been due not to the generator, but to the way in which it was used. The greatest credit is due to Mr. Durston and his staff for the way in which they have recognized and seized on the points which are vital, and for the skill with which a small army of stokers has been trained to do exactly what was wanted with the precision of clockwork. It is no disparagement to the generator if we say that we do not think that outside her Majesty's Navy it would be possible to find so splendidly disciplined a fire-room crew. We venture to think that Mr. Durston will be among the first to admit that everything depends on the way in which the generator is managed—in a word, on the way in which the details of the new process of steam-making are carried out; and we not unnaturally ask, What would happen if the exigencies of warfare should leave such ships as the 'Terrible' with a crew of stokers quite untrained in the new method of steam making? We have no doubt but that for some years to come the Belleville generator will have it all its own way in the Navy. We trust it will not be introduced faster than men are trained in its use; and, indeed, it seems to us to be desirable that the two new ships should be kept in commission for no other purpose than to pass stokers through them as training ships. We believe that fixed boilers on land are intended to be used for this purpose. We venture to say that the conditions on sea and on land are very different, and that training on land must leave much to be desired for sea service."

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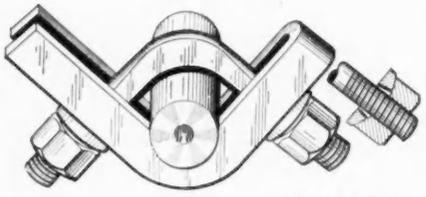

American Machinist

Balanced Lathe Driver.

The clamp driver or lathe dog shown in the cut is in use in England, and we reproduce it as a suggestion to our readers. It is, as will be seen, nearly balanced for any size of work. It is easily made, does not bite into the work to injure it, and should be handy for a wide variety of work. The nuts, it will be noticed, have spherical bearings on the washers.

Letters from Practical Men.

Bilgram Bevel Gear Planers in England.

Editor American Machinist:

In your issue of December 3d, an article on "Planed Bevel Gear Teeth," by George B. Grant, of Boston, occurs. After describing the Bilgram planed tooth, Mr. Grant says: "Outside of Mr. Bilgram's workshops there is but one Bilgram machine at present in use, and that is one owned by the Brown & Sharpe Manufacturing Company." This, we believe, is perfectly correct concerning the United States; but in 1891 we, the undersigned firm, acquired one of Mr. Bilgram's bevel gear planers, and also the right of making the machine for ourselves as well as for the United Kingdom. Since that date we have had the machine in constant use, have built a second one for ourselves, and have a larger machine in course of construction. We should therefore be glad if you would insert this letter in your next issue, so as to correct any wrong impression caused by Mr. Grant's article.

SMITH & COVENTRY, Ltd.

Manchester, England.

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"Limit" Taps.

Editor American Machinist:

Evidently I did not express myself clearly in "Limit Taps," November 26th. Had I done so, Mr. Swift would not have been impelled to make his remarks under the same title on pages 33 to 39 of your issue of January 14th, 1897. With your permission I will explain myself.

The "limit" form of tap, largest in diameter of the bottom of the thread at the leading end, is not an invention of my own. It is very old. All of the taps furnished by a well-known Eastern maker are, in absence of the customer's special instructions to the contrary, largest at the leading end; these taps are preferred to any other commercial taps by large bolt and nut makers, the Port Chester Bolt & Nut Company among others, because of the "limit" feature, which makes it impossible to exceed a fixed limit of variation in diameter of holes tapped, and because of greater length of life, and because of superior ease of working. Hence, I do not and did not "propose" the limit tap. I simply sought to make the action of the originally cylindrical tap, as contrasted with that of the large-nose tap, visible to the eye by exaggerated drawings; so that the pictures might impress those mechanics who are ignorant of practice in shops where tapping is a principal feature of the work done, and who also find it irksome to follow a course of unillustrated reasoning.

Mr. Swift is evidently unfamiliar with the fact that taps require grinding the same as other metal cutting tools, because he says that the "limit" tap will

soon wear small at the leading end. Every time a "limit" tap is ground it will make a smaller finished hole, but the tap itself is always the largest in diameter at the extreme leading end of its cutting part. Mr. Swift speaks of a "steep" taper of the tap at the cutting end. The tap is of the usual form for "hand" taps, the term being used in contradistinction to the very long "taper" cutting part as made on "machine" taps.

Mr. Swift cannot understand how the largest diameter of cut made in a nut by a limit tap must, of necessity, be made with a new and unworn tap-tooth. Take a ½ inch tap, 12 p. i., with, say, $\frac{1}{100}$ inch taper in 1¾-inch thread. This tap will have 21 turns of thread. If it has 4 flutes, there are then in the whole surface of the tap thread 84 cutting teeth, no two of the same radius, the teeth radii varying by the common difference of $\frac{1}{8400}$ inch, considerably less than $\frac{1}{8000}$ inch. Hence, the moment the leading large radius tooth, which is cutting the outside diameter of the nut thread, wears off $\frac{1}{8400}$ inch, the next smaller tooth, which is new and untouched, comes into action. If Mr. Swift is talking about infinitesimal measurements, I am not with him. I am talking about machine-shop possibilities, and $\frac{1}{8000}$ inch is a small enough dimension for these pages.

Once again, I do not and did not "advance" the large-nose reamer idea. The making of rose reamers and fluted reamers of the large-nose form is also very old, and it is, in fact, quite impossible to use a rose-bit which is not larger at the nose than at the rear.

What I did disclose in "Limit Taps" that was new to me, is the using of taps of this form in a series of such a number as would enable the first taps of the series to be worn without reducing the size of the finished work below a certain fixed limit, which limit does not depend on the difference in the diameter of the leading and following ends of the taps. This idea is new to me, and, so far as I know, untried; but I may be wrong in this—the scheme may be old. I believe my plan is feasible, and hope to see it put in practice. The accurate sizing of internal threads is becoming every day a matter of more importance.

HORACE L. ARNOLD.

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Flat and Twist Drills.

Editor American Machinist:

In the discussion of various subjects constantly coming up in the "American Machinist," there is none that it is harder for me to keep out of than that of drills and drilling. Mr. Hemenway's story of flat drills doing better than the twist, suits my idea exactly; but I do not believe the flat drill was superior to the twist because it was flat, but because it was ground just right and the twist drill just wrong, as they always are when they come from the makers and the patent drill-grinding machines. If the steel and temper in the twist drill had been as good as in the flat, and the cutting edge ground the same, it, being stronger, would have stood more push and should have drilled as fast or faster. The curved grinding used on the ordinary twist drill leaves the point conical rather than wedge-shaped, so it does not nose its way into the iron like a flat one, and as a result it heats and goes slow. Thinning up the point by the use of a thin round-edge emery wheel, helps this greatly; but even with this there is another advantage in the flat-drill style of grinding as we use it—that is the saving in breakage.

Fig. 1

The half-tone, Fig. 1, shows a drill ground on this plan, and at first sight would seem to be much weaker; but it only seems so, as will be seen from the following sketches. *A*, Fig. 2, shows the developed surface of the regular twist drill. That is, if a piece of paper be wrapped around a ¾-inch drill and dented over the corners made by the flutes and lip, a figure of about this form will be produced. The strain on this, to force it through the cut, is as the strain on a projecting beam with the load at the end, which is as strong when the metal is cut away in a parabolic curve as if left on. That is to say, the drill would be as strong if made like *B*, Fig. 2, as if like *A*, though not as stiff.

When the drill *A* breaks, the first fracture is at *a* and the triangular piece wedges in, and if the machine is not stopped, the drill breaks up in detail until the top of the hole is reached. If ground like *B*, it would not know where to break except at the top of the hole. If in the form *C*, the fracture takes place at *b*, and the piece gets out of the way with no further harm, and further, the heel left at *c*, which need only just clear, prevents the drill from jumping through a nearly finished hole. Where we have to drill ⅝-inch oil holes diagonally through crank pins from 8 inches to 1 foot in depth, and of necessity in a drill press, the saving in broken drills and the trouble from getting out the broken pieces has been of great value to us.

Many think it necessary to use a flat drill, to drill brass or thin pieces; but the faces of the cutting lips can be ground plumb, or sloping back, and the twist drill do anything that a flat one will. In heavy work, or where the drilling machine has too little power, nicking the cutting edges, as shown at *D*, helps matters. This could be accomplished nicely by fluting the front side of the drill in the manner shown in the "American Machinist" of December 17th, of a foreign patent, except in that design both cutting faces were fluted alike, whereas, to carry out this scheme, the two faces would need to be fluted with an uneven number of mismatched flutes, and it would pay in the case of large and costly drills to have that done.

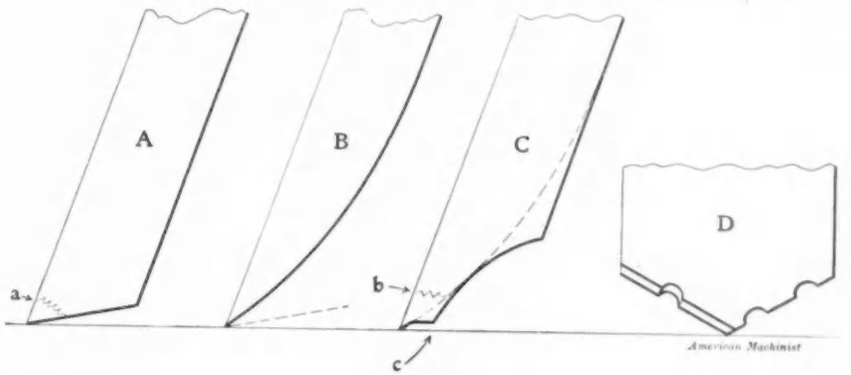

Fig. 2

GRINDING TWIST DRILLS.

JOHN E. SWEET.

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Locomotive Building in Russia.

Editor American Machinist:

In the Commercial Review published in your issue of December 10th, mention is made of the recent purchase of a locomotive building plant in the United States by the Russian Government.

As this appears to be a widely circulated belief, will you kindly permit me to say that the plant in question was bought and will be operated solely by the Sormovo Company, a private concern, whose

only connection with the Government is that a good proportion of the output of the new shops will probably be for State railways?

It may interest you to know that satisfactory progress is being made with the installation of the machinery, which comprises as fine a collection of tools as was ever turned out by American or any other manufacturers.

W. F. DIXON,
Chief Engineer.

Nijni Novgorod, Russia.

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The Circular Inch.

Editor American Machinist:

Will you kindly explain to me Mr. Booth's method of figuring water pressures? In his article on pump balancing, in the "American Machinist," November 12th, he says: "In 100 feet of lift of an 8-inch bucket the weight (of the water) is 2,133 pounds, or the lift in yards multiplied by the square of the diameter in inches." That, of course, is $\frac{100}{3} \times 8^2 = 2.133$, but why is it so, and how far can the same rule be used?

JOEL C. ROBINSON.

[The question of our correspondent seems to be quite opportune, and it may be doing a service to some other of our readers if we attempt to explain the matter. The weight of a cubic foot, or 1,728 cubic inches, of water is about 64¼ pounds. If this cubic foot of water was contained in a vertical pipe 1 inch square and 1,728 inches high, this whole weight of 62¼ pounds would come upon the base of the column. Then the hight of a 1-inch square column that would have a weight or pressure of 1 pound upon the base would be 62.25 : 1 : : 1,728 : 27.75 inches. This would be the hight of a column of water 1 inch square and weighing 1 pound. The area of a circle 1 inch diameter is .7854 square inch; therefore, the hight of column required for the same weight of water in a 1-inch round pipe would be .7854 : 1 : : 27.75 : 35.33 inches.

Mr. Booth merely assumes that this hight of 35.33 inches is 36 inches, the actual difference being less than 2 per cent., while the convenience of it for approximate and hasty computations is very great. The squaring of the diameter of the 8-inch piston gives its area in circular inches or the number of single circular inches that would be equal to it.

If this method is thought to be in any way rough or crude or objectionable, what should be said of the practice, which is quite common, of assuming that each two feet of hight of any water column is equivalent to 1 pound per square inch? The error in this case is 15 per cent., so that the sooner we abandon the use of such a method the better.

We have to do so much with circular areas in connection with pressures that it is to be regretted that we do not more generally employ the circular inch in our computations. We have more figuring to do, probably, in connection with round pistons than anywhere else; and if our pressures were always in circular inches, the work would be much simpler. Say that we have an engine with cylinder 16 inches by 42 inches stroke at 50 revolutions per minute with a mean effective pressure of 37 pounds per square inch. The usual statement for computing the horse-power would be $16^2 \times .7854 \times 37 \times 350 \div 33{,}000 = 78.9$.

In the accompanying table we find that 37 pounds per square inch equals 29 pounds per circular inch, and by the use of it we get rid of the decimal factor .7854, and the statement is then like this: $16^2 \times 29 \times 350 \div 33{,}000 = 78.7$. This result is a little less than the other, because the decimal part of the circular pressure was not used. If we were in the habit of using the pressures per circular inch, they would come to us in whole numbers, instead of with a decimal tagged on, as almost invariably happens when converted from a whole number square-inch pressure.

The accompanying tables have been computed for the convenience of those who may wish to use the circular inch in computations. We have looked through a number of familiar pocket books, and have failed to find such tables, so that we have no doubt they will be welcome to some at least of our readers. We do not see that anything is necessary in the way of explanation as to their use.—Ed.]

TABLE OF PRESSURES PER CIRCULAR INCH CORRESPONDING TO ANY GIVEN PRESSURE PER SQUARE INCH, FROM 1 TO 100 POUNDS.

Pounds per Square Inch.	Pounds per Circular Inch.	Pounds per Square Inch.	Pounds per Circular Inch.	Pounds per Square Inch.	Pounds per Circular Inch.	Pounds per Square Inch.	Pounds per Circular Inch.	Pounds per Square Inch.	Pounds per Circular Inch.
1	.7854	21	16.4934	41	32.2014	61	47.9094	81	63.6174
2	1.5708	22	17.2728	42	32.9868	62	48.6948	82	64.4028
3	2.3562	23	18.0642	43	33.7722	63	49.4802	83	65.1882
4	3.1416	24	18.8496	44	34.5576	64	50.2656	84	65.9736
5	3.9270	25	19.6350	45	35.3430	65	51.0510	85	66.7590
6	4.7124	26	20.4204	46	36.1284	66	51.8364	86	67.5444
7	5.4978	27	21.2058	47	36.9138	67	52.6218	87	68.3298
8	6.2832	28	21.9912	48	37.6992	68	53.4072	88	69.1152
9	7.0686	29	22.7766	49	38.4846	69	54.1926	89	69.9006
10	7.8540	30	23.5620	50	39.2700	70	54.9780	90	70.6860
11	8.6394	31	24.3474	51	40.0554	71	55.7634	91	71.4714
12	9.4248	32	25.1328	52	40.8408	72	56.5488	92	72.2568
13	10.2102	33	25.9182	53	41.6262	73	57.3342	93	73.0422
14	10.9956	34	26.7036	54	42.4116	74	58.1196	94	73.8276
15	11.7810	35	27.4890	55	43.1970	75	58.9050	95	74.6130
16	12.5664	36	28.2744	56	43.9824	76	59.6904	96	75.3984
17	13.3518	37	29.0598	57	44.7678	77	60.4758	97	76.1838
18	14.1372	38	29.8452	58	45.5532	78	61.2612	98	76.9692
19	14.9226	39	30.6306	59	46.3386	79	62.0456	99	77.7546
20	15.7080	40	31.4160	60	47.1240	80	62.8320	100	78.5400

TABLE OF PRESSURES PER SQUARE INCH CORRESPONDING TO ANY GIVEN PRESSURE PER CIRCULAR INCH, FROM 1 TO 100 POUNDS.

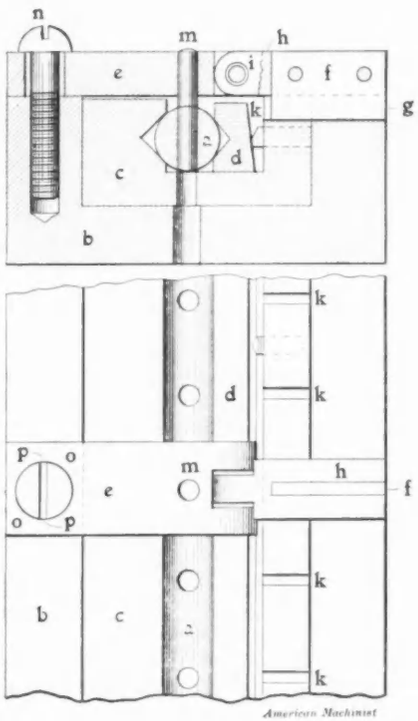
Pounds per Circular Inch.	Pounds per Square Inch.	Pounds per Circular Inch.	Pounds per Square Inch.	Pounds per Circular Inch.	Pounds per Square Inch.	Pounds per Circular Inch.	Pounds per Square Inch.	Pounds per Circular Inch.	Pounds per Square Inch.
1	1.2732	21	26.7378	41	52.2024	61	77.6670	81	103.1316
2	2.5464	22	28.0110	42	53.4757	62	78.9403	82	104.4048
3	3.8196	23	29.2843	43	54.7489	63	80.2135	83	105.6781
4	5.0929	24	30.5575	44	56.0221	64	81.4867	84	106.9513
5	6.3661	25	31.8307	45	57.2953	65	82.7599	85	108.2245
6	7.6394	26	33.1040	46	58.5686	66	84.0332	86	109.4978
7	8.9126	27	34.3772	47	59.8418	67	85.3064	87	110.7710
8	10.1858	28	35.6504	48	61.1150	68	86.5796	88	112.0442
9	11.4591	29	36.9237	49	62.3883	69	87.8529	89	113.3175
10	12.7323	30	38.1969	50	63.6615	70	89.1261	90	114.5907
11	14.0055	31	39.4701	51	64.9347	71	90.3993	91	115.8639
12	15.2787	32	40.7434	52	66.2080	72	91.6726	92	117.1372
13	16.5520	33	42.0166	53	67.4812	73	92.9460	93	118.4104
14	17.8252	34	43.2898	54	68.7544	74	94.2190	94	119.6836
15	19.0984	35	44.5630	55	70.0276	75	95.4923	95	120.9568
16	20.3717	36	45.8363	56	71.3009	76	96.7659	96	122.2301
17	21.6449	37	47.1095	57	72.5741	77	98.0387	97	123.5033
18	22.9181	38	48.3827	58	73.8473	78	99.3119	98	124.7765
19	24.1914	39	49.6559	59	75.1206	79	100.5852	99	126.0498
20	25.4646	40	50.9292	60	76.3938	80	101.8584	100	127.3230

Jig for Drilling Transverse Holes Through Round Rods.

Editor American Machinist:

In a former communication I have shown how to get a hole exactly in the center of a round rod. Having done this in a short piece of steel or brass rod, if it is intended to make a jig for drilling a series of such holes in a longer rod or lot of pieces, the result can be obtained as follows:

Let one piece *a*, drilled or bored centrally, as shown before, be used as found illustrated in the figure. A long cast-iron piece *b* is planed out to receive *c*, and near the center a space *g* is cut out at right angles to receive the tongue piece or slip



DRILLING TRANSVERSE HOLES.

f. This is riveted into the swinging piece *h*, and is hung loosely every way on the pin, simply for convenience and so as not to be lost. It is not intended to affect the jig piece *e* in any way. The bar *c*, accompanied by *d*, holds the rod in place while being drilled, the set-screws being sunk into surface of *c*, which slides in *b*. The piece *c* has a series of notches or spaces in it of any required distance, and these cuts *k* are locked opposite *g* by the slip *f*.

To locate *e* in relation to *a*, use a close-fitting pin *m* in *e* and *a*, as shown. The screw *n* having some play in the piece *e*, is tightened slightly, and *a* is locked tightly with *d*, after which dowel pins *p p* are put in *e*. The work is moved then under *m*, without changing *a* in *c*, being located at *k k*, etc.

A. H. CLEAVES.

The Decimal Index in the Drafting Room.

BY H. W. ALDEN.

Some time since, I visited the drafting rooms of some of the leading Eastern manufacturers to obtain information on new methods and appliances, and everywhere I found a lack—an admitted lack in some cases—of an efficient index system for the drawings and patterns. Some used the alphabetical system; some the arbitrary assignment of certain numbers for certain classes of work; others, still, confessed to no real system whatever.

After no little study and some hesitation, I introduced into my own work an indexing system which has proven sufficiently successful and satisfactory to warrant a description of it, and I trust that a fair and candid trial will prove its worth and adaptability to other drawing rooms. The system has long been used and severely tested in the largest public and private libraries, and has fully met the demands placed upon it. But, so far as I am aware, it has never been introduced into the drafting room. I refer to the decimal system first used by Melville Dewey.

I do not propose the adoption of that part of Mr. Dewey's classification devoted to mechanical engineering, because it is far too general in its nature at present, and not sufficiently subdivided. The work of any drafting room forms too small a part of the general subject of mechanical engineering to permit the use of even a perfect classification of that subject, as the subdivisions would have to be carried too far. But the decimal system of dividing and classifying the work embraced in any office is so simple, so flexible, and so universally adaptable, that it ought to supplant all other systems. While a catalog or index arranged on this principle for one class of work would be unsuited to other classes the system is equally applicable to all and can be readily installed in almost any drafting room.

A brief description of Mr. Dewey's system may lead to a better understanding of what follows, and I shall trespass for a moment on the time of those acquainted with it for the sake of those to whom it may chance to be unfamiliar.

I can do no better than to quote a few lines from the fifth edition of Mr. Dewey's "Decimal Classification and Relative Index," as follows: "The field of knowledge is divided into nine classes, and those are numbered by the digits, 1 to 9. Cyclopedias, periodicals, etc., so general in character as to belong to no one of these classes, are marked nought, and form a tenth class. Each class is similarly separated into 9 divisions, general works, belonging to no division, having nought in place of the division number. Divisions are similarly divided into 9 sections, and the process repeated as often as necessary. Thus 512 means Class 5 (Natural Science), Division 1 (Mathematics), Section 2 (Algebra), and every Algebra is numbered 512.

"The books on the shelves and the cards in the subject catalog are arranged in simple numerical order, all class numbers being decimals. Since each subject has a definite number, it follows that all books on any subject must stand together. Those tables show the order in which the subjects follow one another. Thus 512, Algebra, precedes 513, Geometry, and follows 511, Arithmetic."

Similarly, in the drafting room, the entire list of subjects embraced can readily and logically be divided into ten classes, and these subdivided as far as required. It is no idle assertion that ten classes are sufficient for any drafting room, for the classes can be made to embrace the entire scope of human knowledge, and it will usually be found that several classes will be left vacant for future expansion.

It is not intended that these catalog numbers supplant the usual drawing number. The latter is too useful an assistant in filing away the drawings. It is not even requisite that the catalog number appear on the drawing, although I have found it conventient to have it there. It serves simply to locate in the card index that card which represents the drawing of the same number.

When a drawing is made, reference to the Decimal Catalog or Relative Index (which should always accompany the catalog) will show the catalog number to be used, and a card should be written correspondingly bearing the title of the drawing, its drawing number and its catalog number. These cards are then filed numerically in the card catalog, those cards bearing the same catalog number being filed numerically, according to the drawing numbers. Hence, it will be evident that reference to this card catalog will enable the seeker to find grouped together and readily accessible the cards for all drawings on the subject in mind, whether alphabetically related or not. For instance, in railroad work, rails, fish-plates, ties and spikes are not alphabetically related, but subjectively they are closely connected, and any logical index should place them side by side, for they are all a part of the roadbed; and if one is studying that question, he should have in one group all the drawings—or cards representing drawings—on that subject, and not be put to the necessity of ransacking a profuse—necessarily profuse, if valuable—alphabetical index, running the risk, at the same time, of overlooking some point. He should be able to turn to one part of his card catalog and know that there, in a small space, is everything on the subject he has in hand.

Someone will say, in spite of what I have said above, that drawings should be filed according to the machines for which they are made. Very well, do so. The catalog number is an auxiliary, and in no way

affects the filing of the drawings. Personally, I much prefer the numerical arrangement of drawings for all ordinary work; though I can readily see how, in a consulting engineer's office, the other would be preferable. The point in question, however, is that the decimal catalog is entirely in accord with any convenient arrangement, since its function is simply to locate the drawings on similar subjects.

It is needless to tell any draftsman that this is not the only card index which should be kept. I say "card index," for it is the only logical method of keeping track of drawings. He must have one, and preferably two others, in order at any time to ascertain at a glance all that he might desire to know about his drawings. But as this is not within the scope of this article, I must pass it over. That index most frequently consulted, however, will be the one used for designing new machinery, and one must then be able to quickly and surely locate any and all drawings bearing on the different points presenting themselves in the design.

Below I give an illustration of a small part of a decimal catalog referring exclusively to railroad work. As I am no railroad man, kindly treat the crude and unsatisfactory arrangement there shown as the fault, not of the system, but of the writer. The intention was to seek an illustration at once plain and fairly familiar:

100	ROLLING STOCK.		
110 Locomotives 111 Frames 112 Boilers 113 Valve Mechanism 114 Trucks	120 Coaches 121 Frames 122 Trucks 123 Furnishings	130 Freight Cars	
200	PERMANENT WAY.		
210 Road Bed 211 Ballast 212 Ties 213 Rails 214 Switches	220 Bridges 221 Abutments 222 Trusses 223 Superstructure		
800	TOOLS.		
810 Small Tools 811 For Rolling Stock 812 For Permanent Way 812.13 For Rails	820 Machines 821 (Same as for 810)		

In general, it will be found, unless the work embraced be very broad, that three places will be sufficient for subdivision except in the case of Tools, as given in the table. This class should embrace small tools, jigs, fixtures and special machinery used in the manufacture, perhaps, of everything else mentioned in the entire catalog. The divisions, then, of tools, jigs, etc., should be subdivided decimally beyond the third place as far as desired, or as is necessary to tell at a glance what the jig, fixture or special machine was designed for. This illustrates admirably the flexibility of the system, since at this one point the catalog can be expanded to embrace the entire remaining portions of the catalog without in any way complicating this portion or affecting any other portion.

The practical man will see, I think, that a system capable of unlimited local extension is worthy of more than a passing glance. There is another phase of the question, however, which now presents itself—that of pattern numbers. First of all comes the question, What should a pattern number indicate? It must tell one of two things—either in what group of patterns comprising a certain machine it belongs, or in what group of patterns designed for a specific class of work. If it be simply a consecutive number, it is useless; if it be the number of the drawing on which it is found, it is of some value; but to know for what it was designed, one must refer back to the drawing. To be of greatest service, it must indicate one of the first-mentioned characteristics of the pattern. In many factories whose output runs mostly on staple machines, it is customary to number the patterns with the machine letter and to file together all patterns of one machine. Now, there are many patterns which are used on several machines; and as it would be out of the question to duplicate such, there must, of necessity, be many collections of patterns for individual machines which lack not a few patterns. Those have to be sought in various quarters, and it is no vain imagining to suppose a case where all the patterns of some machine would be scattered here and there among the machines for which they were originally designed. Consequently, the advantage of having together all the patterns for one machine is a questionable one at best. Again, if one were designing a new machine and desired to use as many patterns as possible already made, it would be vastly easier were he able to approach one part of the pattern store-room and find there all the patterns designed for one particular class of work, regardless of their particular machine. If, then, the pattern bore a number indicating the character of work for which it was designed, its number would possess a permanent significance; whereas, if it indicate the machine for which it happened first to be designed, its significance is lost as soon as it is used on a second machine.

The decimal system, if extended to the pattern numbers, fulfills the first of these requirements, while at the same time forming a logical connection between drawings and patterns, and a ready means of interreference, since the number will indicate the kind of work for which it was designed and the group of drawings among which its own is to be found, without the necessity of examining the pattern index.

The pattern number should consist of two parts, the decimal number and a consecutive number in its decimal class, the latter serving not only to identify it in its class, but to show at a glance what is its relation in point of time of design to others in the same class.

In any case where the output of a factory is such as to enable the same pattern to be used on various machines, it certainly were much better to file them by the decimal rather than by the machine system. Most beneficial does this system appear when applied to jigs, fixtures, etc., as it then indicates not only that the pattern belongs to some jig, but also for what that jig is used. Thus, $\frac{812.13}{17}$ would be pattern No. 17 among small tools for use on rails.

I know of no other system providing at once a simple and ready reference for the drawings and a logical pattern number which shall indicate the use for which the pattern was intended. We have seen that, while the alphabetical system offers a fairly good drawing index, it is valueless with reference to the patterns. The numerical pattern number is likewise valueless, the drawing pattern number of some value, and the machine pattern number still more valuable, but open to serious question. The ideal drawing index should group together drawings on kindred subjects. The ideal pattern number should indicate the use for which the pattern was intended. While I do not claim the decimal system to be ideal, nor free from objection, I do claim it to be nearer the ideal than most others, and open to less criticism on those points, at least, wherein the others are weak.

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The Second Annual Convention of the National Association of Manufacturers.

The above-named convention was held according to program in Philadelphia, January 26th, 27th and 28th. The sessions were held in Horticultural Hall on South Broad street, the social headquarters and stopping-place of most of the members being at the Hotel Walton, directly opposite. Horticultural Hall is a handsome and commodious structure, admirably adapted to the purpose, except that its acoustic properties are simply vile—a fact which gave rise to much annoyance.

The meeting was called to order by President Search, and after an address of welcome by Mayor Warwick, and the announcement of the various standing committees, the address and annual report of the president was read. This report was a model of its kind, admirably composed and admirably read. It was a long document (32 printed octavo pages), but was listened to with marked attention and in absolute silence. It outlined the vast amount of work done during the year, and set the pace for a thoroughly business-like and practical convention—a character which was maintained to the end. We are unable, for lack of space, to present more than a very brief abstract as follows:

During the past year the association has grown in membership from about 300

to about 900, and probably represents in capital invested, in value of products and in labor employed, a larger aggregate than any other business organization in the world. It is thoroughly national and represents nearly every industry of importance. It has been marked by peculiar harmony and unanimity. It has a well-organized office force for carrying on its work, as well as numerous agents in foreign countries, and from this organization important results have already been obtained, every foreign mail bringing requests for information regarding the producers and products of this country.

Naturally much work has been done in securing information regarding foreign markets. The South American Commission visited Brazil and the River Platt countries, and was watched with profound interest both at home and abroad, being taken as an illustration of the serious purpose of American manufacturers. The report of this commission, together with that of Mr. Wm. Harper, who made a special trip to Venezuela, are before the association, and in addition to much detailed information, urge the establishment of sample warehouses in South American ports, of which one at Caracas, Venezuela, has been selected as the first to be undertaken.

Another committee was despatched to Mexico, whose investigations convinced them of the growing importance of the markets of that country. Great industrial advance has taken place there within the past ten years—an advance which it is believed has but just begun. The committee advise the establishment of bonded warehouses at various Mexican cities, and in this they have the assurance of the active co-operation of President Diaz and the entire Mexican Government.

Still another commissioner was sent to Japan to study that country, both as a competitor and as a customer. The report of this commissioner is already in type, and while very voluminous, its conclusions are in brief that while in a few industries Japan can produce goods at a cost with which we can not compete, nevertheless the rapid development to be expected there, leads us to expect that the most important relation of that country to our own is likely to be as a profitable customer rather than a dangerous competitor. China, as a profitable customer, was also discussed in a favorable light.

Following these topics, a discussion of the Nicaragua Canal naturally followed as, in a large sense, the key to the transportation problem. Its merits were taken as proven and accepted, and the assistance of the Government in its construction urged.

The restoration of our merchant marine was next taken up, statistics being presented showing that there had been a progressive decrease in the American ocean carrying trade, done in American bottoms, from 81 per cent. in 1845 to 11.7 per cent. in 1895. Government assistance in some form was urged.

Following this came the discussion of the customs tariff. The Executive Committee had drawn up and offered for approval some resolutions which, after reciting the necessity for prompt action, proceeded by saying: "Resolved, That the rates of duties should be as low as possible consistent with the fair protection of our industries and the labor they employ." This did not seem to suit the convention, and, on motion, a committee was appointed to consider the question and report further resolutions. This was understood by many to indicate a hot fight in the effort to commit the association to extreme duties; but if that was the object, it failed, as will be seen below.

Growing out of the tariff came a discussion of reciprocity, which project had the unmistakable sympathy of the convention.

Reform of the consular service was next taken up and urged. In this connection, it was stated that the association is now investigating the qualifications of the present South American consuls. Growing out of this, the establishment of a new department of the Federal Government, to be called the "Department of Commerce and Manufacture," was urged, together with the removal of the consular service from the Department of State, and its incorporation in the new department. It was especially pointed out in justification of the movement, that this country is almost alone among the great governments of the earth in having no such department.

Following this, and completing this most instructive document, came the brief consideration of the protection of American patents and trade-marks abroad, a system of uniform freight classification, a national bankrupcy law, the Paris Exposition of 1900, the Nashville Centennial Exposition, and the incorporation of the association under a national charter. The possibilities of the association for usefulness, it was asserted, in conclusion, are limited only by the means at its command.

At the afternoon session was presented the treasurer's report, showing a revenue for the year of $40,000, and disbursements of $39,000; and following this, the reports of the committees on Transportation, Mexican Affairs, Reciprocity, and Department of Commerce and Manufacture. These reports did not differ in tenor from the corresponding portions of the president's report, the latter being, of them, in fact, a resumé.

The sessions of Wednesday were chiefly occupied in the discussion of the president's report, and the reception and discussion of the reports of various committees. The most important action taken on the president's report was the adoption of a series of resolutions authorizing the president and the Executive Committee to proceed with the Mexican bonded warehouse scheme at their own discretion.

The Tariff Committee presented its report in the afternoon. The resolutions offered for adoption were more voluminous than those previously offered by the Executive Committee, but the clause regarding the rates of duty was in almost identically the same words. Decided objection was made to the words "as low as possible," which, it was moved, should be struck out. A substitute resolution proposed to strike out the word "possible" only, and finally a second substitute was passed by a vote of 75 to 51, making this resolution read as follows: "Resolved, That the duties should be such as will be consistent with adequate protection of our manufacturing and agricultural industries and the labor they employ. The tariff should contain only specific duties or mixed ad valorem and specific duties." The result gave general satisfaction, and the entire series of tariff resolutions, as thus amended, was then passed unanimously. Others of the series urged prompt action by Congress, and also urged the readoption of the principle of reciprocity. Perhaps the most noteworthy and satisfactory single incident of this discussion was the prompt way in which one member was "sat upon" for injecting a trifling amount of political talk into his remarks. It should also be said that the overwhelming feeling of the convention was in favor of moderate duties, such as might be fairly described by the resolution as first reported by the committee. The change was made because it was felt that the resolution in its original form, by including the phrase "as low as possible," might put an expression in the mouths of those who oppose protection, that might be unwise. As put by the president in his report, the necessity for more revenue on the one hand, and the general feeling that extreme duties are not advisable on the other, form a common meeting-ground and basis for satisfactory compromise.

The evening session was devoted to a symposium on foreign trade, in which several prominent men took part. One of the best points brought out was a warning by one speaker against supposing that foreign trade could be secured easily, or that foreign markets could be made a dumping-ground for otherwise unsalable goods. The necessity for representatives abroad being acquainted with the language and customs of the countries visited, was especially urged. One speaker asserted that American woolen goods could not be successfully sold abroad, but American cotton goods, he thought, could compete everywhere except in Europe. Machinery and novelties were also considered as occupying a fair competitive position. In this symposium one prominent speaker took occasion to refer to the American consular service in more

(Continued on page 102.)

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"One-Sided Reports."

We have to reiterate our assertion that we have no special interest in either electricity or compressed air, and no purpose to do any more or any less than full justice to each, and to tell the exact truth, as we can ascertain it, regarding each. Our interests are higher than either of these, and embrace more than both of them. We are chiefly concerned with either simply as a means of power transmission. There are places where for these purposes each agent has its special advantages, and there are comparatively few cases where they come into competition or challenge comparison. Wherever such comparisons are made they should at least have a semblance of fairness, and where gross injustice is done it is in the line of our legitimate business to protest. We know pretty nearly the possibilities of electricity or of compressed air under certain conditions. When a report appears in an "electrical" journal of "a practical test of both systems under similar conditions," and when the ultimate efficiency of the air is given as 9 per cent., while the electrical performance is creditable, we maintain that the "similar conditions" are in fact so dissimilar that there is absolutely no basis for intelligible comparison, and we refuse to consider the report seriously. The "Electrical Engineer," of this city, published the report referred to, and now defends it. If it chooses to deliberately advertise itself as systematically playing the game of "heads I win, tails you lose" in the supposed interest of electricity, we will be glad to do all that we can to help to advertise it. It is this very disposition to exalt and worship electricity and to insist that it is the best and greatest force known to man, and should always be used in preference to any other, regardless of time, place or circumstance, that has, more than anything else, weakened the influence of electrical journals among impartial and disinterested engineers.

Every intelligent engineer examining the report published and defended by our contemporary, knows at once that it is absurd to claim that it throws any light whatever upon the relative advantages of electricity and compressed air. And intelligent electrical engineers know that, to publish and defend such a report as showing the superiority of electricity is, so far as it receives any attention at all, an injury to electrical interests, instead of a benefit to them.

Our contemporary will have learned a valuable lesson when it comes to realize that blind partisanship does not very well agree with the practice of engineering, and that the interest in which such partisanship is enlisted is usually injured, instead of benefited thereby.

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Chas. W. Dabney, Jr., Assistant Secretary of Agriculture, has an article in "Science" for January 15th, advocating the establishment of a "Department of Science" under the Government. By this it is proposed to unite all scientific work of the Government now done in many different departments and bureaus, and Mr. Dabney makes out a very strong argument in favor of his plan. Years ago we called attention to the fact that there ought to be a "Department of Manufactures," the head of which should be a Cabinet officer, and which department should have charge of all Government manufacturing matters, and should look after our manufacturing interests the same as the Secretary of Agriculture now looks after matters connected with the cultivation of crops.

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And now there is another trouble confronting us. Where are the ships to carry our iron to England? Alabama iron is underselling English iron in England. Mr. Haas, President of the Sloss Iron & Steel Company, says that "Southern iron can take care of itself the world over. We have established a solid export trade, the proportions of which are hampered only by the lack of ship room." Alabama iron "is laid down in New York, freight paid, at the price paid for English iron, plus the duty, at the English furnaces, and much cheaper than English iron with the freight added."

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Commodore George W. Melville, Engineer-in-Chief of the Navy, has lately undergone a most severe and dangerous surgical operation, and our readers will be glad to know that, while his condition was for a time quite critical, he is at this writing considered out of danger. The operation was performed on January 19th, and is believed to have eradicated the cause of serious intestinal disorder, contracted in Siberia after the "Jeannette" disaster, and which has frequently since that time threatened his life.

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The Second Annual Convention of the National Association of Manufacturers.

(*Continued from page 101.*)

complimentary terms than those which had been heard in previous remarks.

The session of Thursday morning was devoted to unfinished business, to various matters of a routine nature, and to the election of officers—President Search being most appropriately re-elected. Lunch was served at the Philadelphia Commercial Museum, and the afternoon was spent in inspecting the collections of that institution. The objects of the museum were explained by General Manager Harper. In brief, they may be said to be threefold: First, the collection of the raw materials exported by all countries; second, the collection of the manufactured goods imported by all countries; and third, the maintenance of a bureau of information. The museum maintains paid correspondents throughout the world, and has a large membership in its Advisory Board, elected by chambers of commerce and other foreign bodies in various countries. Information of the most detailed character regarding foreign markets, prices, dealers, etc., are collected and placed at the disposal of all, while the collections (with prices attached) serve to show where purchases and sales can be made. The institution is supported at public expense by the city of Philadelphia and the State of Pennsylvania. It occupies temporary quarters at 233 South Fourth street, a lease of five years having been made to allow sufficient time for the preparation of permanent buildings. A lot comprising sixteen acres has been secured, and $200,000 appropriated for the commencement of buildings. The visitors were greatly impressed with the completeness of the organization, the magnitude of the collections already obtained,

and the vast possibilities of the institution in furthering foreign trade.

In the evening a banquet was held at the Bourse—tendered by the Philadelphia members to the visiting members and invited guests.

Thus closed a convention remarkable in the history of American commercial affairs. The business-like and practical nature of the work done, and of the discussions held, was conspicuous above all other features. No one attending the convention can doubt that if the work of the association is continued on the lines already entered upon, great results must follow.

This notice should not close without reference to the handsome hospitality displayed. Telephone, telegraph and carriage service were free to all, as well as tickets to places of amusement. It was, in fact, about impossible to spend anything except for hotel bills. It is but fair to say, also, that in this respect the example of Cincinnati two years ago set the pace. The Philadelphians felt they could not, and they certainly did not, do less than their brethren of the city on the Ohio.

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Louis H. Hart, Secretary of the American Society of Heating and Ventilating Engineers, and business manager of the journal called "Heating and Ventilating," died at his residence, Brooklyn, N. Y., on the 25th ult. Mr. Hart formerly lived in Connecticut and had been a member of its State Legislature. He took a prominent part in the organization of the society above referred to.

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Business Specials.

Transient Advertisements 40 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Gear wheels, gear cutting. Grant; see page 16.

Scientific Machinist, Cleveland, O., wants agents.

Good brass castings. H. D. Phelps, Ansonia, Ct.

Forming Lathes. Mer. Mach. Tool Co., Meriden, Ct.

Milling Machs. Kempsmith Co., Milwaukee, Wis.

Engine Castings ⅛ to 2 H. P. Finished boilers and engines. Grant Sipp, Paterson, N. J.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Duplex and special gear cutters, counterbores, cutter and surface grinders, vertical millers, hand punches and shears. R. M. Clough, New Haven, Ct.

The American Ball-Bearing Co., of Cleveland, have exceptionally good facilities for the manufacture of bicycle cups and cones; tempering, case hardening and grinding are a specialty with them.

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Help Wanted.

Situation and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

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whose names appear on our **subscription** list, this paper will give two free insertions under this heading to those in want of positions. The advertisement to occupy a space of not more than five lines. Additional space or insertions must be paid for in advance at regular rates.

Help Wanted—Good pay for leisure hours. Geo. W. Lord, Philadelphia, Pa.

First-class draftsman wants a position in or near New York. Box 53, AMERICAN MACHINIST.

Mech'l draftsman wants to change; col. ed.; exp. and refs.; moderate salary. Box 58, AM. MACH.

Position by A 1 pattern maker; young but experienced; desires to advance. Box 57, AMER. MACH.

Wanted—Position as foreman of machine shop by man of experience and thoroughly up to date; A 1 reference. Box 54, AMERICAN MACHINIST.

Draftsman and designer, extensive experience on high-speed engines, special tool and jigs, wants position. Address Box 52, AMERICAN MACHINIST.

Draftsman—Young man with technical education in mechanical engineering; experience in street railway construction. Box 50, AMER. MACHINIST.

Wanted—The services of a first-class mechanical engineer; one familiar with the constr. and operation of steam hammers preferred. Address, stating salary expected, Box 47, AMERICAN MACHINIST.

Wanted at Once—One first-class machinist; one that can work and take charge of men doing general jobbing and building special machinery; state age, wages expected, also references. Box 55, AMERICAN MACHINIST.

Wanted—An experienced pattern maker to take charge of pattern shop in architectural iron works; must be thoroughly familiar with stair work and all kinds of ornamental iron work. Address James McKinney & Son, 925-933 Broadway, Albany, N. Y.

Change desired by exp. mach. and tool maker; large exp. as foreman in mfg. type-writers, cash-registers, sewing-mach. and similar work; can produce work accur'tely and econom'y on gear-cutters, presses, milling and sew. mach. Box 46, AM. MACH.

Wanted—A machine tool fitter on fine class of work; none but first-class need apply; must be of steady and temperate habits and a hustler; a steady job to the right man. Address, stating age, experience, references and wages expected, Box 51, AMERICAN MACHINIST.

Wanted—A first-class designer of modern light machine tools; position open abroad in a large manufacturing establishment; no applications can be considered except from thoroughly capable men; suitable salary will be paid. Reply, giving full details as to qualifications, to box 56, AMERICAN MACHINIST.

Wanted—Position as salesman, local or traveling; 10 years' road experience on steam engines, boilers and engine supplies in every State and territory in this and several foreign countries; first-class machinist, able to handle largest trade. Address Steam Engines, Care Nelson Chesman & Co., 509 Temple Court, N. Y.

A 1 expert and thorough mechanic on gas and gasoline engines, at present holding responsible position with large concern manuf'g gas engs., wishes to change; will accept pos as manager or as general traveling salesman and expert with a firm that appreciates ability and inventive genius developing gas engines to highest efficiency, and electric lighting with same, a specialty. Box 1, AM. MACH.

▲ ▲ ▲

Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d h'd lathes & planers. S. M. York, Clev'd, O.

Calipers & Gauges. F. A. Welles, Milwaukee, Wis.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co., Springfield, Mass.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Boye, Cincinnati, O.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., of Spring and Varick streets, New York City.

Gas engine patent for sale cheap; several engines in use; best of references; simple and reliable. Box 59, AMERICAN MACHINIST.

We make a specialty of Shartle's patent safety set collars. Prices low and samples free. Middletown Machine Co., Middletown, Ohio.

For Sale—Entire equipment of a jewelry factory, whole or in part; Reed lathe, 12 in. x 5 ft.; also smaller lathe, presses, drop, rolls, gas furnaces, etc. Leward, 95 William st.

Wanted—An Idea. Who can think of some simple thing to patent? Protect your ideas; they may bring you wealth. Write John Wedderburn & Co. Patent Attorneys, Washington, D. C., for their $1,800 prize offered to inventors.

Commercial Review.

NEW YORK, SATURDAY EVENING, JAN. 30TH.

STEAM POWER MACHINERY.

If expectation counts for anything, the market impresses one now as in a state healthier than for some time past. The volume of actual business up to date does not appear from local indications, to be much, if any, increased, but that there is a betterment in undertone is the view held by a number of sellers.

Talk is cheap, we will admit, and the years back to 1892 have been crammed full of unfulfilled promises, but there is something about the present opinions of many persons in close touch with the market that smacks of substantiality. It is affirmed with confidence that buyers are laying their plans and making their preparations to go ahead and act; that they are in earnest this time; and that we have but to wait for one or two months until spring is exerting its subtle influences upon men and machines, to see these preparations materialize into orders.

This remark for instance: "No, I don't think things are as bad as they might be. During the three years in which I have been in the boiler business in New York, I don't know of a time when the outlook has been better than it is to-day. The disposition shown by buyers leads me to believe that an improvement in the boiler trade and kindred lines is soon to be looked for—that is, legitimate business, to fall into the hands of sellers of good standard articles who are in the market to stay there."

In regard to the outlook for supplying steam plants to New York buildings, it is said that those of Sherry and Delmonico are likely to be in the market for them as soon as any. The threatened law limiting the height of buildings has occasioned the precipitate filing of a number of plans therefor in order to forestall such action; but these being safely on record will probably not be proceeded with in a hurry.

Those who come to New York to shop for steam engines and similar bric-a-brac will find that some of their business ac-

Glass Body Oil Pumps

Are a necessity if you desire thorough lubrication.

LUNKENHEIMER'S is the pioneer in the field and is giving universal satisfaction. No engine should be without a cup of this kind. Our Pocket Catalogue will acquaint you with its valuable features; gratis.

▲ ▲ ▲

THE LUNKENHEIMER CO.,

Headquarters, CINCINNATI, O.

New York Store, 51 John Street.

European Store, 35 Gt. Dover St. London.

quaintances are moving into the Beard building, a tall structure just completed at No. 120 Liberty street. The Ball & Wood Engine Co. have crossed over from Cortlandt street and taken offices therein, the Wheeler Condenser and Engineering Company have done the same, and the New York branch of the Henry R. Worthington Co. is scheduled to occupy the lower floor. We understand that a new building is to be erected on the corner of Liberty street and Broadway, which also may be destined as a home for the commercial side of the mechanical arts.

We give below reports from some of the steam goods people who find that business is already improving.

W. R. Fleming & Co., agents for the Ide and Ideal engines, have had a better business this month than hitherto, in respect to both inquiries and actual sales. They have recently installed in the Mergenthaler linotype works, Brooklyn, N. Y., a steam power plant including two engine units to connect directly with two 100 kilowatt dynamos; the transmission being electrical from the engines to the line shafts, but not to the individual machines. In export work they have an unfulfilled contract for an engine of about 500 horse-power, intended for electrical purposes in Mexico.

This is the experience of the Weston Engine Co.: "Business has been exceptionally good of late, indeed, since about December 1st, and we have been running 23 hours out of the 24. Orders still keep coming in, which may be due to the fact that our new engine, which has been on the market for the last three or four months, is becoming known; this being the type on which we are now busy. We are having considerable export correspondence. An engine recently ordered of us is for a large electric lighting plant for a sugar refinery in Macoris, San Domingo, C. A."

FACTS AND FIGURES OF FOREIGN TRADE.

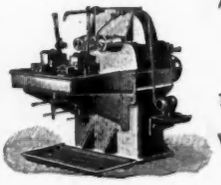
Statistics for the calendar year 1896 show that our entire domestic exports, as the figures were latest corrected, amount to $,86,-844,193, against $807,742,145 in 1895, and $807,312,116 in 1894. The ground lost as a result of the business collapse of four years ago has been recovered in a most satisfactory manner. A feature of present exports is the unprecedented volume of manufactured goods which they comprise, amounting in 1896 to $253,688,527.

The Ferracute Machine Co., Bridgeton, N. J., who have done much foreign business of late in supplying bicycle and electrical manufacturing establishments in Europe beside the order for minting machinery received by them some time ago from the Chinese government, have closed the year actively at work and able to declare a pretty good semi-annual dividend.

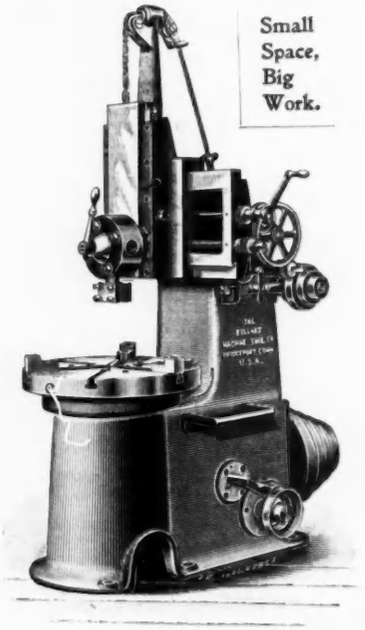
(Continued on page 37.)

NEW IMPROVED
TAPPING MACHINE
25,000 holes tapped per day.
Description mailed.
Machinery and Tools.
Brass Machine Screws.
HARVEY HUBBELL,
33-35 Organ St.,
Bridgeport, Conn.

DIXON'S 219½
Drafting Pencil
Is superior to the very finest imported pencils for making fine, black lines, clear and distinct. Lines do not smut and have no feather edges.
Mention AMERICAN MACHINIST.
And send 10 Cents for Samples.
JOS. DIXON CRUCIBLE CO.
JERSEY CITY, N. J.



Automatic Solid Die Bolt
THREADING MACHINES.
Two Styles. Four Sizes.
Send for Catalogue "A."
Webster & Perks Tool Co.
Cor. Spring and Monroe Sts.,
Springfield, Ohio.



Small Space, Big Work.

Turret Head Mill
SAVES MONEY ON BORED, TURNED OR FACED PARTS.
The Bullard Machine Tool Co.
BRIDGEPORT, CONN., U. S. A.

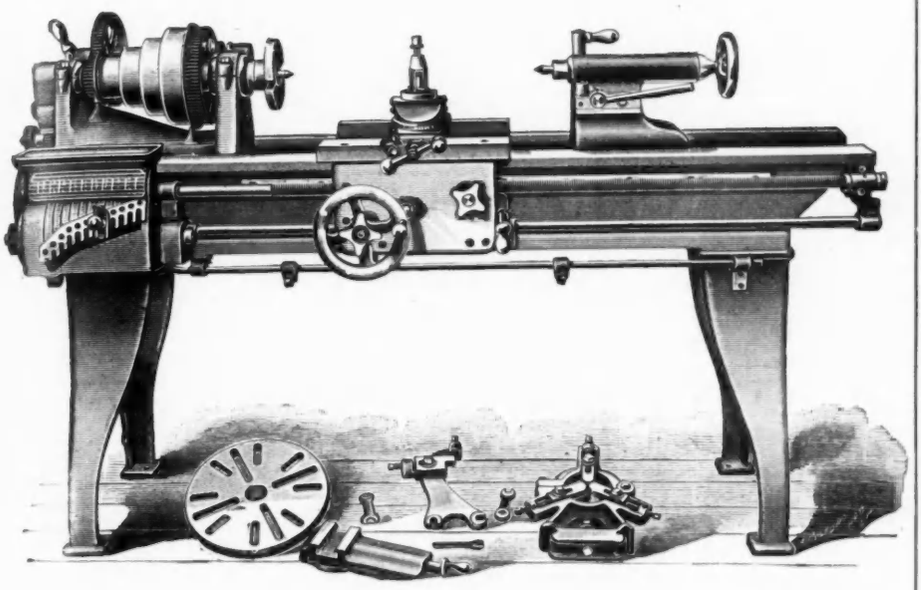
Columbia University
in the City of New York.
SCHOOL OF MINES,
SCHOOL OF CHEMISTRY,
SCHOOL OF ENGINEERING,
SCHOOL OF ARCHITECTURE,
SCHOOL OF PURE SCIENCE.
Four years' undergraduate courses and special facilities for graduate work in all departments. Circulars forwarded on application to the Secretary of the University.

We Claim that it will do more work than any similar tool in the market. No danger of breaking tools.
Never back live spindle.
THE UNION TIRE CO.
PLAINFIELD, N. J.
MAKERS OF
THE FULMER
Drilling and Tapping Attachment.
Drills and taps ho es either through or bottom, without reversing or stopping machine.

The best Bicycle Brazing Solder is the 'Ball's Wire Spelter' made by Montgomery of N. Y. It is not the cheapest. The best '97 wheels will use it. Get samples, make up your mind and place your orders early.
Montgomery & Co.
105 Fulton St.
New York City.

PLANERS
LANE SHAPER
FITCHBURG MACHINE WORKS
FITCHBURG, MASS., U. S. A.
METAL-WORKING MACHINERY.
CATALOG E.
ER
SHAPERS

THIS LATHE COMBINES THE LATEST AND BEST IMPROVEMENTS.



14 in. x 6 ft. Hendey-Norton Lathe

With Improved Automatic Stop.

• • •

AUTOMATIC STOP

It is durable, simple, indispensable. It will automatically stop the carriage in either direction. It is equally efficient whether feeding or thread-cutting, running up to a shoulder, boring to bottom of holes, or internal thread-cutting. No danger of spoiling either tool or work. It is a safeguard against accidents in either direction.

CARRIAGE

The carriage reverses in apron; no slamming of countershaft. There is no comparison between this lathe and the old style or common lathe.

THREADS

It has all threads in daily use with simple movement of lever.

FEEDS

Has all feeds in daily use with simple movement of lever. Send for Circular.

• • •

THE HENDEY MACHINE COMPANY,

Torrington, Conn.

Agents for the Pacific Coast, PACIFIC TOOL AND SUPPLY CO., San Francisco, Cal.

European Agents, { **CHAS. CHURCHILL & CO., Ltd., London and Birmingham.**
SCHUCHARDT & SCHÜTTE, Berlin and Vienna.
EUGENE SOLLER, Basel, Switzerland.

(Continued from page 36.)

THE IRON MARKET.

The famous American Bessemer Association or Billet Pool was dissolved January 29th.

Quotations.

NEW YORK, Monday, February 1st.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$12 00 @ $13 00
No. 2 foundry, Northern	11 50 @ 12 00
No. 2 plain, Northern	11 25 @ 11 50
Gray Forge	10 50 @ 11 50
No. 1 foundry, Southern	11 50 @ 12 00
No. 2 foundry, Southern	11 00 @ 11 25
No. 3 foundry, Southern	10 50 @ 11 00
No. 1 soft, Southern	11 00 @ 11 50
No. 2 soft, Southern	10 50 @ 11 00
Foundry forge, or No. 4 Southern	10 25 @ 11 00

Bar Iron—Base—Mill price, in carloads, on dock; common, 1.10 @ 1.15c.; refined, 1.20 @ 1.50c. Store prices: common, 1.40 @ 1.50c.; refined, 1.50 @ 1.80c.

Tool Steel—Ordinary sizes, standard quality, 6 @ 7c., with some brands perhaps a little less; extra grades, 11 @ 12c.; special grades, 16c and upward

Machinery Steel—Ordinary brands, from store, 1.60 @ 1.65c.

Cold Rolled Steel Shafting—Base size, 2.60 @ 2.65c., from store.

Copper—Carload lots, Lake Superior ingot, 12.00c.; electrolytic, 11⅝ @ 11¾c.; casting copper, 11⅛c.

Pig Tin—For 5 and 10-ton lots, 13.75 @ 13.85c., f. o. b.

Pig Lead—In carload lots, 3.12½ @ 3.15c., f. o. b.

Spelter—In carload lots, New York delivery, 3.95 @ 4.05c., f. o. b. and upward.

Antimony—Cookson's, 7¼c.; Hallett's, 6⅞ @ 6.90c

Lard Oil—Prime city, present make, commercial quality, in wholesale lots, 40 @ 42c.

▲ ▲ ▲

Manufactures.

At Brokensword, O., Mr. Chas. Margraff will erect a machine shop.

Andrew Anderson, of Central City, Col., is having erected a new mill.

The Berks Foundry, Reading, Pa., Mr. John Ege, proprietor, is being enlarged.

A new varnish factory will be built by the Akron Varnish Company, Akron, O.

The Peoria Grape Sugar Company, Peoria, Ill., will increase the capacity of its plant.

Hubbard & Co., Pittsburg, Pa., have projected an addition 150 x 75 feet to their plant.

The Burgess Steel & Iron Company, Portsmouth, O., intend to establish a new steel plant.

The machine shop of John T. Longill, Erie Basin, Brooklyn, N. Y., was recently burned.

The Midvale Steel Works, Nicetown, Pa., will extend its ordnance machine shop 128 feet.

A new smelting plant is to be erected at San Diego, Cal., by B. T. Moston and C. H. Scott.

At Alton, Ill., the Duncan Foundry Company has begun the erection of an addition to its shop.

The Greenlee Bros. & Co.'s wood-working machinery plant was recently destroyed by fire.

The Slaymaker-Barry Company, Connellsville, Pa., are to erect an iron foundry at that place.

At Chicago, Ill., a new factory will be erected by the J. P. Smith Shoe Company at a cost of $60,000.

At Harrisville, N. Y., Messrs. Pessinger & De Billier have decided to erect a wooden ware factory.

The Henry McShane Manufacturing Company, Dundalk, Ind., will make extensive additions to its plant.

At Sioux City, Ia., the W. M. Thompson Company has been incorporated to manufacture engines and boilers.

It is expected that the Atlanta, Knoxville and Northern R. R. will erect machine shops at Elizabeth, Ga.

At Belfield, Va., Mess. Pert, Nields & McCormick are building a large plant which will be used as a planing mill.

The Burgess Cut Glass Company, of Middletown, Conn., will build an addition to their shop in the early spring.

The new machine shop of the National Foundry

and Pipe Works, at Scottdale, Pa., is in course of construction.

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A new knitting company has been formed at Waterloo, N. Y. The directors are John J. Bockee and Arthur B. Hopkins.

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The Pratt & Whitney Co. HARTFORD, CONN., U.S.A.

...MAKERS OF...

Fine Machine Tools.

Complete Plants furnished for Bicycle, Typewriter, Gun and Sewing Machine Makers. Gauges and Small Tools for all Machine Work. Drop Hammers and Trimming Presses. Forging and Trimming Dies for all classes of work.

England—BUCK & HICKMAN, 280 Whitechapel Road, London, E.
France—FENWICK FRERES & Co., 21 Rue Martel, Paris.
Germany and Austria—SCHUCHARDT & SCHUTTE, Berlin and Vienna.
Chicago—42 and 44 South Clinton St. *Boston*—281 Franklin St. *New York*—123 Liberty St.

Full Mounted Lightning Screw Plate.

A STOCK WITH EACH DIE.

Also "Lightning" and "Green River" Screw Plates, Dies, Taps, Tap Wrenches, Bolt Cutters, Drilling Machines, Punches, Presses, etc.

...Send for Catalogue...

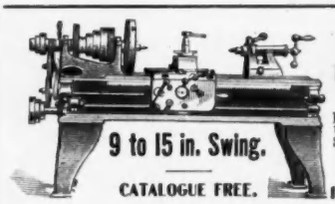
Wiley & Russell Mfg. Co., Greenfield, Mass., U. S. A.

Agents in London, SELIG, SONNENTHAL & Co., 85 Queen Victoria Street.

Machinery.

ROBINSON — "Mechanism," - - - - - - $3.00
CROMWELL — "Toothed Gearing," - - - - - 1.50
CROMWELL — "Belts and Pulleys," - - - - - 1.50
MacCORD — "Kinematics," - - - - - - 5.00

JOHN WILEY & SONS,
53 East Tenth Street, NEW YORK CITY.



CATALOGUE FREE.

4 POINTS!!!! Design! Workmanship! Material! Finish!

All these are comprised in the make-up of our lathes and are the four necessary points in the construction of a good tool. Add to these a FIFTH and a very important one, the price, which we make very low to prompt cash buyers, and you have the story. Our Catalogue will tell you all about our Lathes, Planers, Shapers, etc.

SEBASTIAN LATHE COMPANY,
117 and 119 Culvert Street, CINCINNATI, OHIO, U.S.A.

DYER & DRISCOLL,
PATENT SOLICITORS, 36 WALL ST., N.Y.

Have done all my patent soliciting work, both for this and foreign countries, continously for the past fourteen years.

Thomas A. Edison

STAR LATHES

★★★

Foot Power Screw Cutting, Automatic Cross Feed, 9 and 12" Swing.

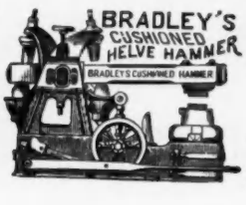
Send for Catalog B.

Seneca Falls Mfg. Co.
697 Water St., Seneca Falls, N.Y.

WHEN YOU ARE OFFERED JENKINS' or JENKINS BROS.' DISCS that have Trade Mark same as cut, they are all right for high pressure steam. All others are imitations and you cannot hold us responsible. If you cannot get our discs from your dealer, send to us for them.

JENKINS BROS., 71 John Street, New York.
31 N. Canal St., Chicago. 117 N. 4th St., Philadelphia. 105 Milk St., Boston.

Norton Emery Wheel Co.
SEND FOR ILLUSTRATED CATALOGUE
Worcester, Mass.



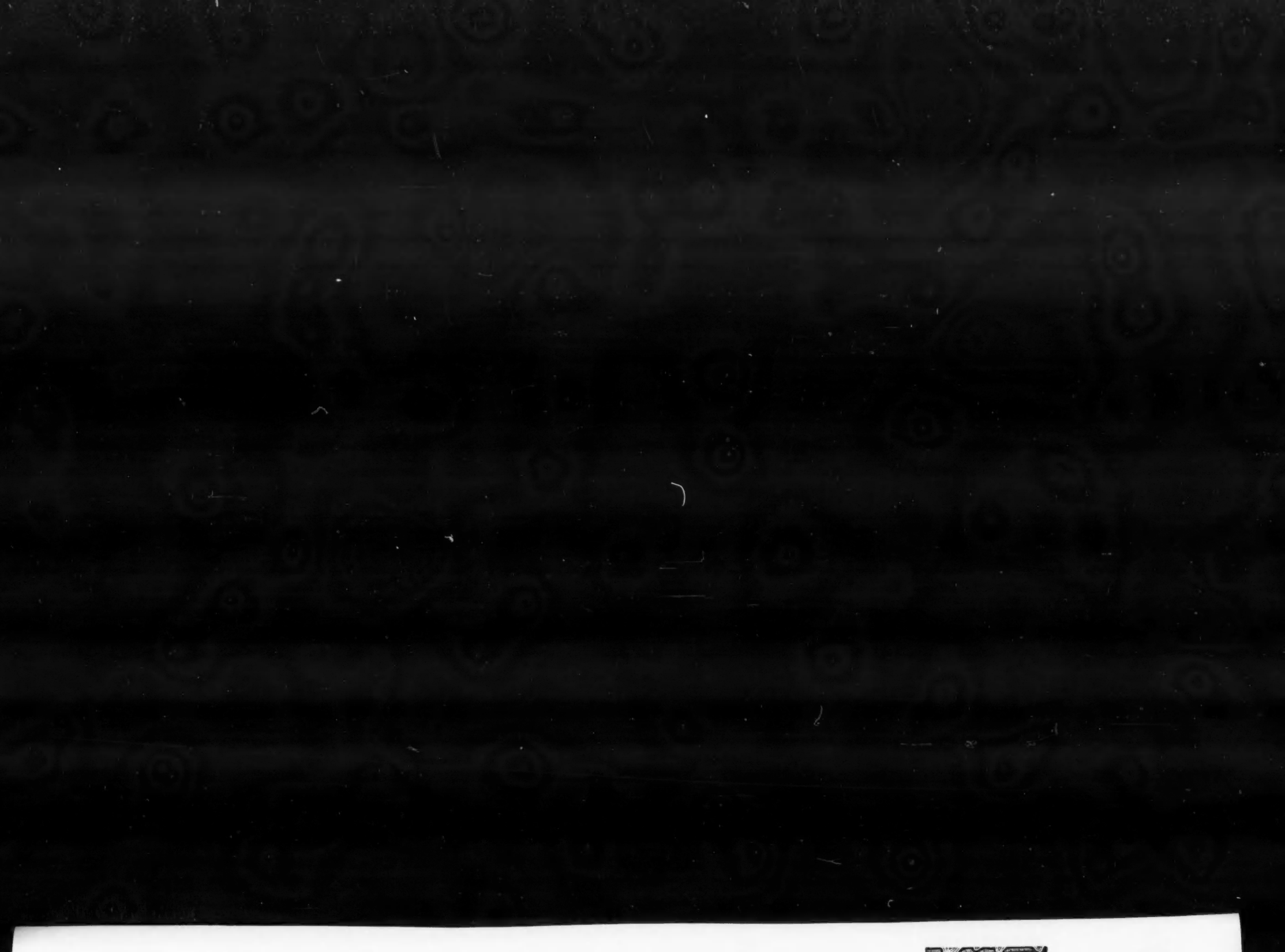
BRADLEY HAMMERS

THE BEST POWER HAMMERS ON EARTH.

22 sizes in Helve, Upright and Strap Styles.

Send for Printed Matter.

The Bradley Company
Syracuse, N. Y.



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Fine Machine Tools.

Complete Plants furnished for Bicycle, Typewriter, Gun and Sewing Machine Makers. Gauges and Small Tools for all Machine Work. Drop Hammers and Trimming Presses. Forging and Trimming Dies for all classes of work.

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Full Mounted Lightning Screw Plate.

A STOCK WITH EACH DIE.

Also "Lightning" and "Green River" Screw Plates, Dies, Taps, Tap Wrenches, Bolt Cutters, Drilling Machines, Punches, Presses, etc.

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Machinery.

ROBINSON — "Mechanism," - - - - - - $3.00
CROMWELL — "Toothed Gearing," - - - - - 1.50
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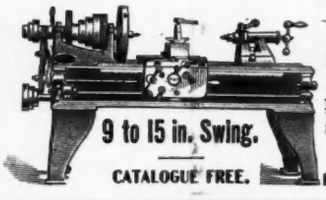

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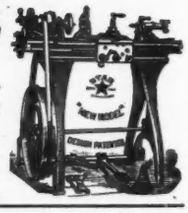

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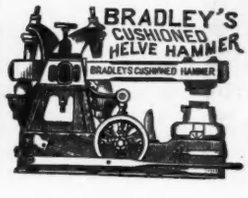

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